# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVI. No. 1483.] LONDON, OCTOBER 28, 1890. [42ND YEAR. Price 6d.



**WOLSTON'S** Paste and Guaranteed Free from Adulteration. **TORBAY** Ready Mixed for Use. **PANTS.**

**FOR GASHOLDERS, &c., &c.**

**The Original "Torbay Paints"** As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.

*Special Quotations to Gas Companies.*

**TORBAY & DART PAINT Co., Ld.,**
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
**PARKER & LESTER,**
Manufacturers & Contractors.

THE ONLY MAKERS OF
**PATENT ANTIMONY PAINT,**
**Parker's Imperial Black Varnish,**
*Oxide Paints, Oils, and General Stores for Gas and Water Works.*

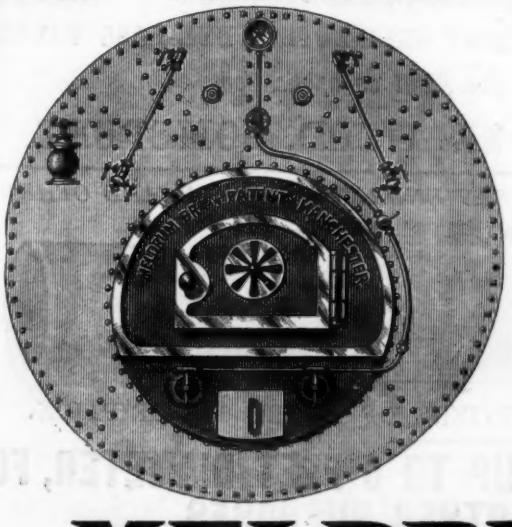
WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

**Ashmore, Benson, Pease, & Co., Ld.,**
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
*See Advertisement, p. 820.*

**CEMENT**
**EARLE'S**
BEST
**Portland Cement**
MANUFACTURED BY
**GEO. & THOS. EARLE,**
**HULL.**
Office: 7, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

NORTON'S PATENT
**"ABYSSINIAN" & ARTESIAN TUBE WELLS,**
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz.:—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
**LE GRAND & SUTCLIFF,**
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

**SELF-CONTAINED DUST FUEL FURNACE.**



OVER 200 WORKING,
RAISING STEAM WITH COKE DUST, COAL DUST, TOWNS' REFUSE AND OTHER WASTE FUEL.

GLASGOW: F. J. ROWAN, 121, West Regent Street.
LONDON: WM. BOBY, 16, Union Court, Old Broad Street
GERMANY, AUSTRIA, BELGIUM, SWITZERLAND, ITALY } ALFRED WEUNER, Manchester.

**MELDRUM BROS.,**
26, HALF STREET, MANCHESTER.

# DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

## GASHOLDER & BOILER WORKS,

**WEST BROMWICH, NEAR BIRMINGHAM**

(ESTABLISHED 1765),

## MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

*PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,*

**Wrought-Iron Roofs, Bridges, Girders, &c.,**

**Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.**

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

---

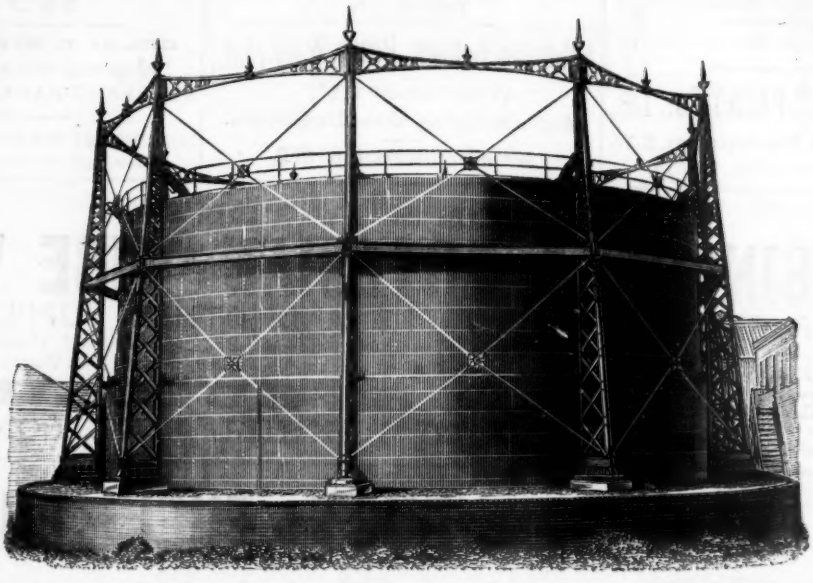
TELEGRAPHIC ADDRESS: "COCKEY'S FROME."

# EDWARD COCKEY & SONS, Ld.,

ESTABLISHED OVER HALF A CENTURY.

**Gas Engineers, Ironfounders, & Contractors,**

**Manufacturers of** *GASHOLDERS and TANKS, BOILERS and ENGINES, ROOFS, EXHAUSTERS, BREEZE SCREENS, CHARGING and COKE BARROWS.*



**Manufacturers of** *PATENT WASHERS, PATENT VALVES for PURIFIERS, &c., GOVERNORS, LAMP COLUMNS, Weighbridges, COKE BREAKERS.*

**SOLE MAKERS OF COCKEY AND SMITH'S PATENT SELF-ACTING BYE-PASS VALVES.**

*Estimates for any description of Gas Plant on application.*

**THE IRON-WORKS, FROME SELWOOD, SOMERSET.**

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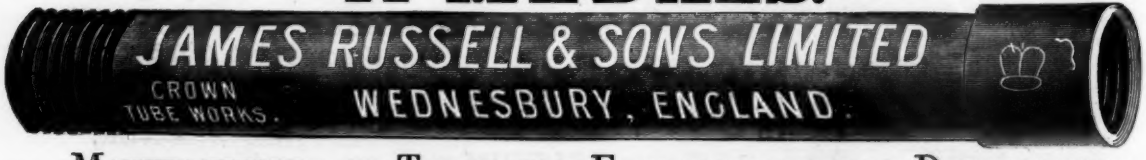
*HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.*

**—11 MEDALS.—**




MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

**WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.**

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

**LONDON:** 108, Southwark Street.

**BIRMINGHAM:** 114, Colmore Row.

**LEEDS:** 6, Mark Lane, New Briggate.

# THOMAS PIGGOTT & CO.,

*Established 1822*

— SPRING HILL, BIRMINGHAM, —

MANUFACTURERS OF

**GAS APPARATUS**
*Of every description.*

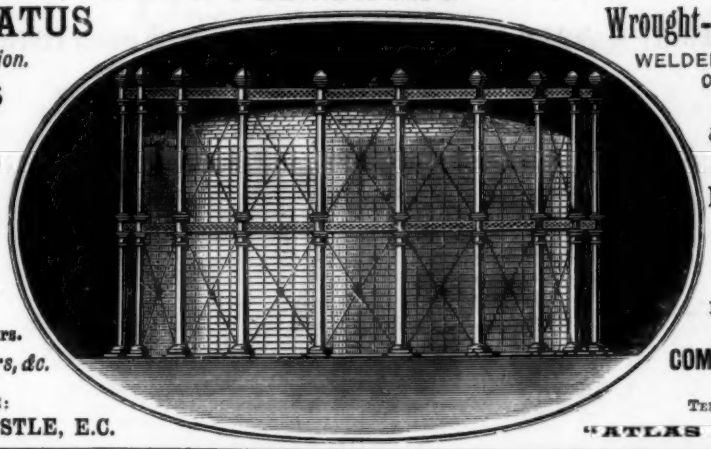
**GASHOLDERS**
AND TANKS.

RETORTS, PURIFIERS, VALVES, SCRUBBERS, CONDENSERS, ETC., ETC
*All of the most approved designs.*

BOILERS, ENGINES, PUMPS.

**Beale's and other Exhausters.**

*Meters, Gauges, Governors, &c.*



**Wrought-Iron Ascension-Pipes**
WELDED AND RIVETTED PIPES OF ALL KINDS OVER 8 INCHES DIA.

*SOMERVILLE'S PATENT*
**RETORT MOUTHPIECES**
AND
**SELF-SEALING LIDS.**
*No luting required.*

Drawings, Specifications, and Estimates prepared for
**COMPLETE GAS PLANTS**

LONDON OFFICE:
**14, ST. THOMAS APOSTLE, E.C.**

TELEGRAPHIC ADDRESS:
**"ATLAS BIRMINGHAM."**

# RETORT SETTINGS IMPROVED

BY ADOPTING

## THE "NUGENT" & "ROBUS" SETTINGS.

**ECONOMY WITH DURABILITY GUARANTEED.**

**HUNDREDS OF SETTINGS WORKING EMINENTLY SATISFACTORY.**

***Estimates and Particulars for every Description of Retort Extensions and other Work.***

## J. & H. ROBUS,

**CONTRACTORS FOR GAS AND WATER WORKS,**

**20, BUCKLERSBURY, LONDON, E.C.**

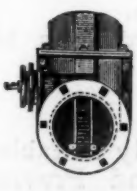
# NEWTON, CHAMBERS, & CO., LIMITED,

**THORNCLIFFE IRON-WORKS, near SHEFFIELD,**

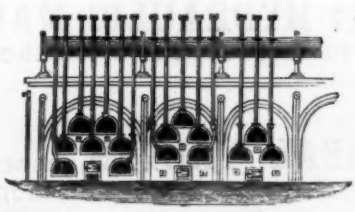
MANUFACTURERS OF

**SLIDE VALVES,**
WITH RACK & PINION,
OR
Internal or External SCREWS, of all Sizes.

**GASHOLDERS,**
AND
Gasholder Tanks.



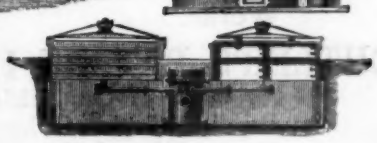
**CAST-IRON RETORTS,**
**RETORT-BED FITTINGS,**
*And Retort-House Appliances*
of every description.
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.



WROUGHT AND CAST IRON
**CONDENSERS, SCRUBBERS, & WASHERS,**
TAR AND LIQUOR PUMPS, &c.

PATENT
**CENTRE VALVES**
for working Purifiers.
Also Bye-Pass & Stop Valves.

**PURIFIERS with Planed Joints,**
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,
**WOOD GRIDS.**
CAST AND WROUGHT IRON TANKS AND CISTERNS.



**DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.**

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

**GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.**

# CROSSLEY'S "OTTO" GAS-ENGINE.

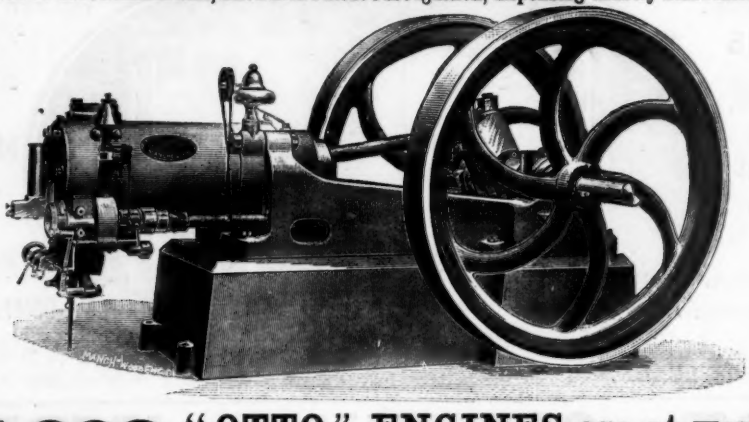
**100 Prize Medals.**

**MADE in SIZES** *2-Man to 100-HP.*

**GAS-ENGINES** COMBINED WITH **PUMPS** FOR TOWNS SUPPLY, SEWAGE, &c., &c.

**GAS-ENGINES** COMBINED WITH **AIR COMPRESSORS** FOR THE SHONE SEWAGE SYSTEM, LUCIGEN LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



**MADE in SIZES** *2-Man to 100-HP.*

VERTICAL AND HORIZONTAL TYPES.

**ENGINES** *COMBINED* WITH HOISTS, PUMPS DYNAMOS, &c., &c.

*Largely used for EXHAUSTING, PUMPING, COKE CRUSHING, ELECTRIC LIGHTING, &c., &c.*

**Over 31,000 "OTTO" ENGINES are at work.**

**CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,** LONDON, LIVERPOOL, GLASGOW, NEWCASTLE, BIRMINGHAM, HULL.

## HARRIS & PEARSON,

**STOURBRIDGE, ENGLAND.**

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

# S. CUTLER & SONS.

Offices: 16, Great George St., Westminster. Works: Millwall, London.

*Apparatus of every description for Gas and Water Works.*

**MORRIS & CUTLER'S PATENT "PERFECT" CONDENSER.**
The most efficient condensing apparatus obtainable. In use at 60 Works, and now in course of erection at Melbourne, Hornsey, Winchester, Ware, &c.

**LIVESEY AND TANNER'S PATENT DIFFERENTIAL TAR AND LIQUOR OVERFLOWS FOR HYDRAULIC MAINS.**
A neat and effective apparatus to remove Tar from the Hydraulic Main and ensure a light Liquor Seal.
300 Sets in successful operation.

**CUTLER'S PATENT WATER-SEAL VALVES,** especially suitable for large Mains at Purifiers. In use at important London and Provincial Works.

**CUTLER'S PATENT FREEZING PREVENTER AND CIRCULATOR** for cups of Gasholders. Now being fitted to Holders at the Works of The Gaslight and Coke Company, and at the Imperial Continental Works at Hanover and Vienna.

*Further particulars of these and other useful specialities will be supplied on application to the Westminster Office.*

# JOSEPH CLIFF & SONS,

INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
*Baltic Wharf, Waterloo Bridge.*
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
*16, Lightbody Street.*
LEEDS:
*Queen Street.*

## MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

**Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.**

ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS
HUNSLET,
LEEDS

LONDON OFFICE:
60, QUEEN VICTORIA STREET
E.C.

# CLAYTON SON & CO. LTD.

MAKE A

SPECIALTY
OF
GASHOLDERS

AND
MAKERS
OF

REG^D TELEGRAPHIC ADDRESS:
"GAS LEEDS"

## GAS PLANT OF EVERY DESCRIPTION.

# THE WIGAN COAL & IRON CO., LIM^TD.,

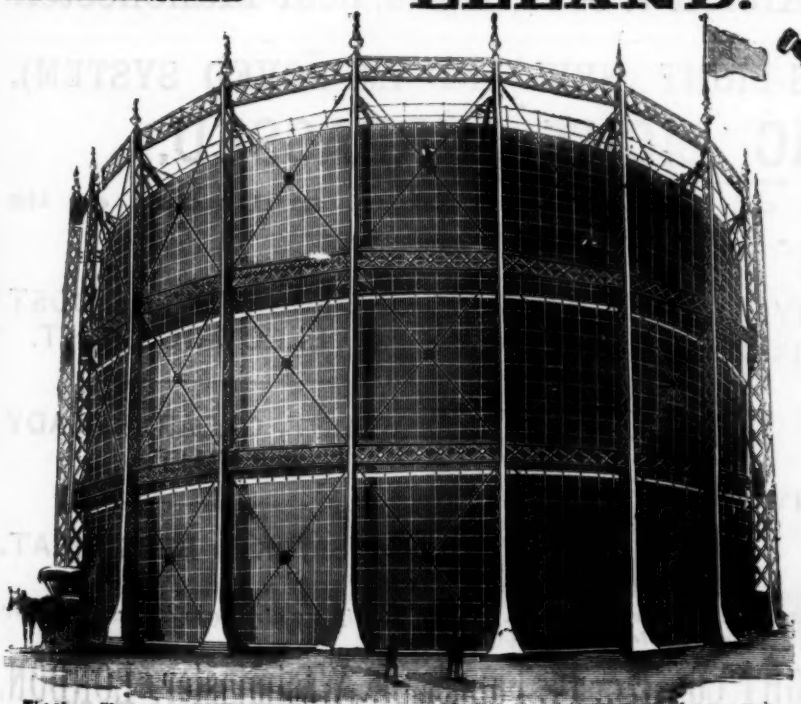
**Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.**

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

# R. DEMPSTER & SONS, Ltd.,

## ROSE MOUNT GAS ENGINEERING WORKS,

ESTABLISHED — **ELLAND.** — 1855.



The above illustrates a TREBLE-LIFT GASHOLDER, 194, 191, and 188 feet diameter by 35 feet deep each, as made for the MELBOURNE GAS COMPANY.

GAS AND CHEMICAL PLANT OF EVERY DESCRIPTION / ALL SUNDRIES SUPPLIED.

OUR
**ROTARY EXHAUSTERS**
Are acknowledged to excel in efficiency and finish.

OUR IMPROVED
**COKE-BREAKING MACHINE**
Is a pronounced success.

**Designs, Specifications, and Estimates submitted on application to**

## R. Dempster & Sons, Ltd.,
ELLAND.

## JOHN HALL & CO.,

**STOURBRIDGE,**

MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
RETORTS CAREFULLY PACKED FOR SHIPMENT.
A STOCK OF DIFFERENT SHAPES ON HAND.

## GAS AND WATER PIPES

AND

## CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

## CLAY CROSS COMPANY,

## CHESTERFIELD.

| TRADE | TELEGRAMS: | LONDON AGENTS: |
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| C X C | "JACKSON" | BECK & Co., |
| MARK. | CLAY CROSS. | 130, GT. SUFFOLK ST., S.E. |

## SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

## DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,

## GODDARD, MASSEY, & WARNER,

ENGINEERS,

**NOTTINGHAM.**

The Apparatus has been supplied to the following Firms—

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

| | | |
|---|---|---|
| ILKESTON. | BURY. | CHORLEY. |
| WIDNES | BRIGHOUSE. | WHITEHAVEN. |
| HALIFAX. | MARKET HARBRO'. | CHESTER. |
| ALTRINCHAM. | PRESCOT. | SOUTH SHIELDS. |
| DENTON. | SOWERBY BRIDGE. | LEEK. |
| ST. ALBANS. | LEICESTER. | IPSWICH. |
| DUKINFIELD. | DARWEN. | BOURNEMOUTH. |
| NORTHWICH. | NELSON. | SALFORD. |
| HUDDERSFIELD. | ORMSKIRK. | LUTON. |
| | | HAMPTON COURT. |

## RUSCOE'S PATENT MACHINE

FOR DRILLING AND TAPPING WATER-MAINS AND GAS-MAINS UNDER PRESSURE.

Patent Saddle Back and Drilling Apparatus, whereby Gas and Water Mains can have 2-in., 3-in., 4-in., 5-in., and 6-in. Branches put on without loss of Water or Gas.

**Sole Maker of HELPS' PATENT PIPE EXTRACTOR.**

Prices and Particulars on Application to

## JOHN RUSCOE, Albion Works, Hyde, near Manchester.

## INCANDESCENT GAS-LIGHT (NEW AND IMPROVED SYSTEM).

## ELECTRIC LIGHT SURPASSED.

**All the advantages of the Electric Light and none of its drawbacks.**

EVERY GAS COMPANY SHOULD TAKE UP THIS SYSTEM.

CAN BE USED WITH ANY GAS-FITTINGS.

ONE-FOURTH THE COST OF ELECTRIC LIGHT.

A SOFT, CLEAR, STEADY LIGHT.

NO SMOKE. LESS HEAT.

*Gas Companies and Gas Engineers placed on the best terms. For descriptive circulars and any further particulars, apply to the*

## INCANDESCENT GAS-LIGHT CO., Ld., 14, Palmer St., Westminster, LONDON.

# KIRKHAM, HULETT, & CHANDLER'S, LTD.,

## NEW PATENT

# "STANDARD" WASHER.

## EXTRACTS the WHOLE of the AMMONIA

Also a Large Proportion of $H_2S$ and $CO_2$ from Gas.

**MINIMUM WEIGHT IN MOTION.**
**MINIMUM DRIVING POWER.**
**MINIMUM BACK PRESSURE.**
**MINIMUM WEAR AND TEAR.**
**WITH MAXIMUM RESULTS.**

*The following List comprises the orders received for PATENT "STANDARD" WASHERS constructed according to the Company's latest patent, and Renewals effected by the application of same to old pattern Machines.*

**NEW PATENT "STANDARD" WASHERS.**

| | Capacity, cub. ft. per 24 hours. |
|---|---|
| THE GASLIGHT AND COKE COMPANY— | |
| Kensal Green | 3,000,000 |
| ,, | 3,000,000 |
| West Ham | 3,000,000 |
| Liverpool | 3,000,000 |
| Rochdale | 3,000,000 |
| Manchester | 2,500,000 |
| Glasgow | 2,500,000 |
| ,, | 2,500,000 |
| Leicester | 2,250,000 |
| Melbourne | 1,500,000 |
| Charlottenburg | 1,500,000 |
| Derby | 1,500,000 |
| ,, | 1,000,000 |
| Cambridge | 1,000,000 |
| Nice | 875,000 |
| Barcelona | 875,000 |
| Magdeburg | 750,000 |
| Valparaiso | 600,000 |
| Halle | 600,000 |
| Barry and Cadoxton | 500,000 |
| Workington | 500,000 |
| Lowestoft | 500,000 |
| Erfurt | 400,000 |
| St. Chamond | 350,000 |
| Atlas Steel Works, Sheffield | 250,000 |
| Lille | 250,000 |
| Rawmarsh | 200,000 |
| Vercelli | 200,000 |
| Hitchin | 150,000 |

**RENEWALS.**

| | |
|---|---|
| THE GASLIGHT AND COKE COMPANY— | |
| Beckton | 2,500,000 |
| ,, | 1,250,000 |
| Nine Elms (in part) | 3,000,000 |
| Shoreditch ,, | 2,500,000 |
| Pimlico ,, | 2,000,000 |
| Bromley ,, | 2,000,000 |
| SOUTH METROPOLITAN GAS COMPANY— | |
| Vauxhall (in part) | 3,000,000 |
| Birmingham ,, | 5,000,000 |
| Croydon | 1,500,000 |
| Edinburgh | 1,500,000 |
| West Ham | 1,500,000 |
| Nottingham | 1,500,000 |
| Melbourne | 1,500,000 |
| ,, | 1,500,000 |
| Maidstone | 1,000,000 |
| Kingston-on-Hull | 400,000 |
| Harrow | 250,000 |
| Buxton | 250,000 |

## Testimonial from the Chief Engineer of The Gaslight & Coke Co.

*The Gaslight and Coke Company, Horseferry Road, Westminster, S.W.,*
*Nov.* 25, 1889.

Messrs. KIRKHAM, HULETT, AND CHANDLER, LIMITED,

GENTLEMEN,—In reply to your enquiry respecting the result of putting "Wooden Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.—I am, yours truly,

(Signed) G. C. TREWBY.

*NOTE.—The first Washer referred to in the above was fitted with improved "Bundles" in May,* 1888; *and these have proved so satisfactory that The Gaslight and Coke Company have had several other "Standard" Washers fitted in the same manner, and have recently given an order for machines for* 6,000,000 *cubic feet per day.*

## PALACE CHAMBERS, BRIDGE STREET,

WESTMINSTER, S.W.

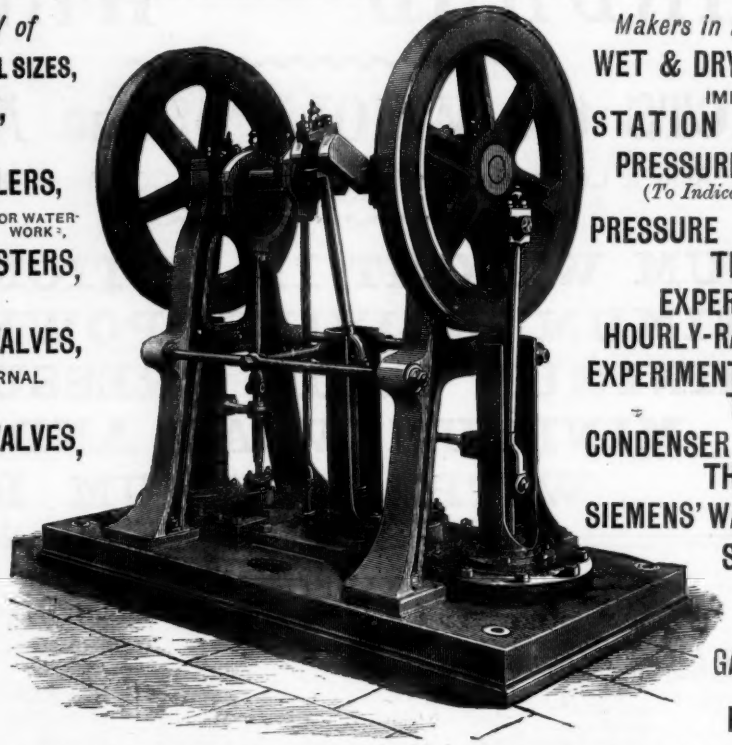
# R. LAIDLAW & SON,

## GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

*Makers in GLASGOW of*

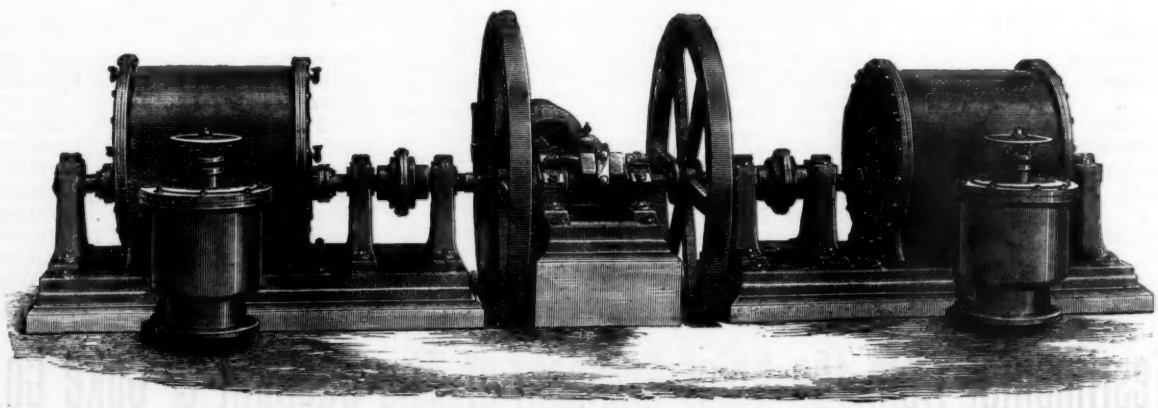
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES FOR WATER-WORKS,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL AND EXTERNAL RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES,
FITTINGS, &c.



*Makers in EDINBURGH of*

WET & DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS
*(To Indicate Now Time)*,
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
*And all Kinds of*
GAS APPARATUS AND FITTINGS, &c.

PUMPING GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

*Prices, with full Particulars, will be given on application.*

**Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,**
INTERNATIONAL EXHIBITION, EDINBURGH, 1886.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

# TANGYES LIMITED,

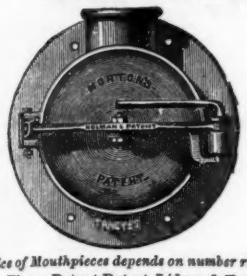
CORNWALL WORKS, BIRMINGHAM.

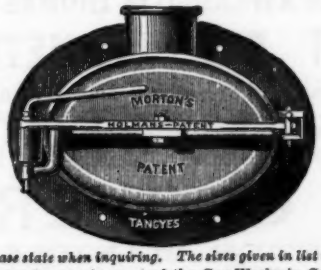
DEPÔTS AT

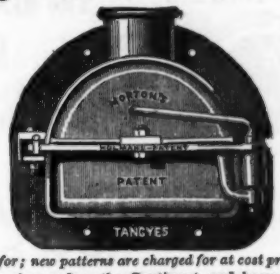
LONDON . . . . . 35, QUEEN VICTORIA ST., E.C. | MANCHESTER . . . . . DEANSGATE
NEWCASTLE-ON-TYNE ST. NICHOLAS BUILDINGS | GLASGOW . . . . . ARGYLE STREET

Sole Makers of **MORTON'S** Patent Self-Sealing **RETORT-LIDS,**

With Anti-Friction CATCHES, and Self-Sustaining CROSS-BARS.




*Price of Mouthpieces depends on number required, which please state when inquiring. The sizes given in list we have patterns for; new patterns are charged for at cost price.*

These Patent Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, D, oval, and round (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

**Mouthpieces with Circular Lids for Oval Retorts.**

| Pattern No. | Diam. Mouth. | Internal Dimensions of Retort. | Length of Mouthpiece. | PRICE, Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 13658 | 14 ins. | 14 × 12 ins. | 15 ins. | £0 19 0 |
| 4356 | 14 „ | 18½ „ 12 „ | 19¾ „ | 0 19 0 |
| 6851 | 15 „ | 16 „ 14 „ | 13 „ | 1 0 0 |
| 3629 | 15 „ | 18½ „ 13½ „ | 14 „ | 1 0 0 |
| 3580 | 15 „ | 21 „ 15 „ | 15 „ | 1 0 0 |
| 6264 | 16 „ | 18½ „ 15½ „ | 15¾ „ | 1 1 0 |
| 5210 | 16 „ | 20 „ 14 „ | 15 „ | 1 1 0 |
| 6263 | 16 „ | 24 „ 16 „ | 13½ „ | 1 1 0 |
| 5370 | 17 „ | 20 „ 14 „ | 14 „ | 1 3 0 |
| 6832 | 17 „ | 20 „ 14 „ | 17 „ | 1 3 0 |
| 6183 | 17 „ | 20 „ 15 „ | 15 „ | 1 3 0 |
| 4289 | 17 „ | 21 „ 15 „ | 14 „ | 1 3 0 |
| 5270 | 17 „ | 22 „ 14 „ | 14 „ | 1 3 0 |
| 3631 | 18 „ | 18 „ 14 „ | 20 „ | 1 5 0 |
| 3681 | 18 „ | 21 „ 14 „ | 13½ or 15 „ | 1 5 0 |
| 3554 | 18 „ | 21 „ 15 „ | 14¾ „ | 1 5 0 |
| 7957 | 18 „ | 22 „ 16 „ | 14 „ | 1 5 0 |
| 8048* | 19 „ | 25½ „ 15 „ | 18 „ | 1 8 6 |

**Mouthpieces with Oval Lids for Oval Retorts.**

| Pattern No. | Dimensions of Mouth. | Internal Dimensions of Retort. | Length of Mouthpiece. | PRICE, Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 9800 | 18 × 14¾ ins. | 18 × 14¾ ins. | 15 ins. | £1 5 0 |
| 9205 | 20 „ 12 „ | 24 „ 14 „ | 10½ „ | 1 10 0 |
| 10000 | 20½ „ 14½ „ | 20½ „ 14½ „ | 15 „ | 1 10 0 |
| 9680 | 21 „ 15 „ | 21 „ 15 „ | 15 „ | 1 12 0 |
| 10056 | 21 „ 14½ „ | 21 „ 14½ „ | 15¾ „ | 1 12 0 |
| 13218 | 21 „ 15 „ | 21 „ 15 „ | 17 „ | 1 12 0 |
| 10514 | 22½ „ 13¾ „ | 22½ „ 13¾ „ | 13¾ „ | 1 13 0 |
| 13766 | 20 „ 17 „ | 20 „ 17 „ | 15½ „ | 1 15 0 |
| 13289 | 24 „ 15 „ | 24 „ 15 „ | 16 „ | 1 18 0 |

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**Mouthpieces for Round Retorts.**

| Diam. .. .. .. .. .. ins. | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|
| Price, Lid and Fittings without Mouthpiece £ | 0 19 0 | 1 0 0 | 1 1 0 | 1 3 0 | 1 5 0 |

**Mouthpieces with Circular Lids for D Retorts.**

| Pattern No. | Diam. Mouth. | Internal Dimensions of Retort. | Length of Mouthpiece. | PRICE, Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 5348 | 14 ins. | 14 × 13 ins. | 7 ins. | £0 19 0 |
| 3463 | 15 „ | 15 „ 13 „ | 14 „ | 1 0 0 |
| 6678 | 15 „ | 15 „ 14 „ | 12 „ | 1 0 0 |
| 3661 | 15½ „ | 15½ „ 13 „ | 12 „ | 1 1 0 |
| 13052 | 16 „ | 16 „ 13 „ | 18 „ | 1 1 0 |
| 5601 | 16 „ | 16 „ 14 „ | 15 „ | 1 1 0 |
| 6827 | 16 „ | 16 „ 14 „ | 17 „ | 1 1 0 |
| 4494 | 16 „ | 16 „ 14 „ | 14 „ | 1 1 0 |
| 3548 | 16 „ | 16 „ 15 „ | 19¾ „ | 1 1 0 |
| 6677 | 16 „ | 16½ „ 13½ „ | 19½ „ | 1 1 0 |
| 9645 | 16 „ | 16½ „ 13½ „ | 19½ „ | 1 1 0 |
| 4434 | 16 „ | 17¾ „ 14 „ | 14 „ | 1 1 0 |
| 6469 | 16 „ | 18 „ 14 „ | 15 „ | 1 1 0 |
| 9015 | 16 „ | 18 „ 14 „ | 18½ „ | 1 1 0 |
| 4327 | 16 „ | 18 „ 15 „ | 15½ „ | 1 1 0 |
| 6049* | 16 „ | 18 „ 15 „ | 17½ „ | 1 1 0 |
| 6137 | 16 „ | 20¼ „ 13½ „ | 13½ „ | 1 1 0 |
| 5918 | 17 „ | 18 „ 14 „ | 14 or 17 „ | 1 3 0 |
| 5053 | 17 „ | 19½ „ 12 „ | 14¼ „ | 1 3 0 |
| 7548 | 17 „ | 20 „ 12 „ | 15 „ | 1 3 0 |
| 6468 | 17 „ | 20 „ 16 „ | 15½ „ | 1 3 0 |
| 4316B | 17 „ | 21 „ 14 „ | 14 „ | 1 3 0 |
| 7975 | 17 „ | 21 „ 15 „ | 14¼ „ | 1 3 0 |
| 13459 | 17 „ | 21½ „ 13½ „ | 15 „ | 1 3 0 |
| 12990 | 18 „ | 18 „ 15 „ | 15 or 19 „ | 1 5 0 |
| 7135 | 18 „ | 18½ „ 15 „ | 13 „ | 1 5 0 |
| 10221 | 18 „ | 18 „ 16 „ | 19¾ „ | 1 5 0 |
| 4506 | 18 „ | 20 „ 13 „ | 19½ „ | 1 5 0 |
| 6475 | 18 „ | 20 „ 13 „ | 15 „ | 1 5 0 |
| 6818 | 18 „ | 20 „ 13½ „ | 17⅞ „ | 1 5 0 |
| 4083 | 18 „ | 20 „ 15 „ | 16 „ | 1 5 0 |
| 5306 | 18 „ | 20½ „ 14 „ | 13½ „ | 1 5 0 |
| 13295 | 18 „ | 20½ „ 14 „ | 19½ „ | 1 5 0 |
| 7356 | 18 „ | 20½ „ 13½ „ | 13 „ | 1 5 0 |
| 4569 | 18 „ | 21 „ 14 „ | 18 „ | 1 5 0 |
| 3628 | 18 „ | 21 „ 15 „ | 16 „ | 1 5 0 |
| 7640 | 18 „ | 22 „ 12½ „ | 13½ „ | 1 5 0 |
| 7971* | 20 „ | 20 „ 15 „ | 18 „ | 1 11 0 |

*Patterns marked * have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.* 191

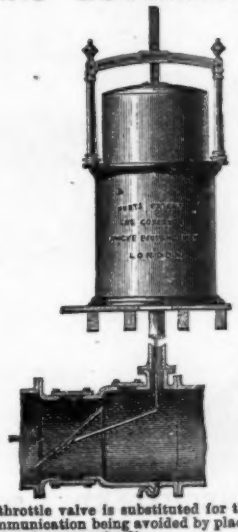
**Mouthpieces with D Lids for D Retorts.**

| Pattern No. | Dimensions of Mouth. | Internal Dimension of Retort. | Length of Mouthpiece. | PRICE, Lid and Fittings without Mouthpiece. |
|---|---|---|---|---|
| 12292 | 15½ × 13 ins. | 15½ × 13 ins. | 13 ins. | £1 2 0 |
| 9967 | 16 „ 14 „ | 16 „ 14 „ | 15½ „ | 1 3 0 |
| 13574 | 16¾ „ 13¾ „ | 16¾ „ 13¾ „ | 13½ „ | 1 4 0 |
| 9899 | 18 „ 12 „ | 18 „ 12 „ | 14 „ | 1 4 0 |
| 12980 | 16 „ 16 „ | 16 „ 16 „ | 18 „ | 1 6 0 |
| 13900 | 18 „ 13¾ „ | 18 „ 13 „ | 15 „ | 1 6 0 |
| 9912 | 18 „ 13½ „ | 18 „ 13½ „ | 17 „ | 1 6 0 |
| 9962 | 18 „ 13½ „ | 18 „ 13½ „ | 16 „ | 1 6 0 |
| 10982 | 18 „ 13½ „ | 18 „ 14 „ | 15 „ | 1 6 0 |
| 11098 | 18 „ 14 „ | 18 „ 14 „ | 12 „ | 1 6 0 |
| 9492 | 20 „ 13 „ | 20 „ 13 „ | 15 „ | 1 10 0 |
| 9208 | 20 „ 13 „ | 20 „ 13 „ | 19½ „ | 1 10 0 |
| 10251 | 20 „ 13 „ | 20 „ 13 „ | 15½ „ | 1 10 0 |
| 12964 | 20 „ 13 „ | 20 „ 13 „ | 18½ „ | 1 10 0 |
| 9909 | 20 „ 13¾ „ | 20 „ 13¾ „ | 17 „ | 1 10 0 |
| 12969 | 19½ „ 15½ „ | 19½ „ 15½ „ | 14 „ | 1 11 0 |
| 13781 | 20 „ 15 „ Front. / 21 „ 15 „ Back. | 21 „ 15 „ | 15 „ | 1 11 0 |
| 7692 | 21 „ 15½ „ | 21 „ 15½ „ | 16 „ | 1 11 0 |
| 12978 | 20 „ 16 „ | 20 „ 16 „ | 17 „ | 1 11 0 |
| 13252 | 20 „ 16 „ | 20 „ 16 „ | 18 „ | 1 11 0 |
| 13220 | 21 „ 15 „ | 21 „ 15 „ | 17 „ | 1 11 0 |
| 8977 | 21½ „ 13¾ „ | 21½ „ 13¾ „ | 18½ „ | 1 11 0 |
| 8976 | 21½ „ 13¾ „ | 21½ „ 13¾ „ | 18½ „ | 1 12 0 |
| 10497 | 21½ „ 13¾ „ | 21 „ 13½ „ | 18½ „ | 1 12 0 |
| 8037 | 21½ „ 13¾ „ | 21½ „ 13¾ „ | 18½ „ | 1 12 0 |
| 9908 | 21½ „ 13½ „ | 21½ „ 13½ „ | 15 „ | 1 12 0 |
| 10404 | 21½ „ 13¾ „ | 22 „ 14 „ | 18½ „ | 1 12 0 |
| 12410 | 21½ „ 13¾ „ | 22 „ 14 „ | 12 „ | 1 12 0 |
| 13822 | 21½ „ 13¾ „ | 22 „ 14 „ | 15 „ | 1 12 0 |
| 10515 | 22½ „ 12¾ „ | 22½ „ 12¾ „ | 13½ „ | 1 12 0 |
| 7924 | 24 „ 14 „ | 24 „ 14 „ | 15½ „ | 1 13 0 |
| 13807 | 24 „ 15½ „ | 24 „ 15½ „ | 16 „ | 1 14 0 |
| 9015B | 25 „ 14 „ | 25 „ 14 „ | 13½ „ | 1 14 0 |
| 10932 | 25 „ 14 „ | 24 „ 14 „ | 13½ „ | 1 15 0 |
| 12944B | 22 „ 16 „ | 22 „ 16 „ | 16 „ | 1 15 0 |

*Patterns marked B have curved bottoms.* 192

HUNT'S PATENT EQUILIBRIUM DIRECT MAIN

## GAS GOVERNOR.



In this Governor a throttle valve is substituted for the ordinary suspended cone; all external communication being avoided by placing the lever or radius arm inside the valve chamber upon the disc.

The disc is carried upon steel centres, upon which it is accurately balanced.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 ins. .. £17 0 | 8 ins. .. £25 0 | 14 ins. .. £42 0 | 20 ins. .. £60 0 |
| 5 „ .. 20 0 | 10 „ .. 33 0 | 16 „ .. 46 0 | 24 „ .. 72 0 |
| 6 „ .. 22 10 | 12 „ .. 38 0 | 18 „ .. 50 0 | 36 „ .. 130 0 |

195

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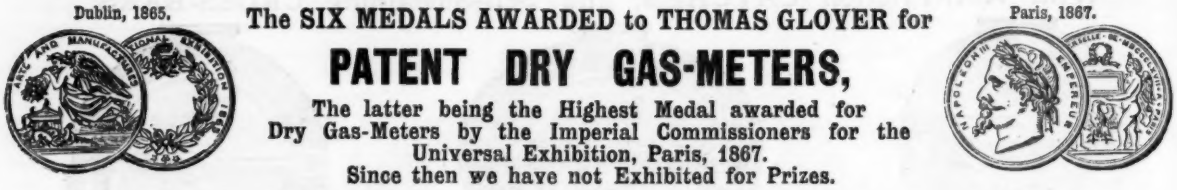
ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.



The SIX MEDALS AWARDED to THOMAS GLOVER for

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The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

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**3rd—Incur no loss of Gas by Evaporation.**
**4th—Cannot become fixed by Frost, however severe.**
**5th—Are the most accurate and unvarying measurers of Gas.**
**6th—Prevent jumping or unexpected extinction of the Lights.**
**7th—May be fixed either above or below the level of the Lights.**
**8th—Cannot be tampered with without visibly damaging the outer case.**
**9th—Will last much longer than Wet Meters.**
**10th—Will not cost more than one-half for repair that Wet or Water Meters do.**
**Are upheld for five years without charge.**

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## STATION METERS

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FITTED WITH PATENT

**THREE-PARTITION DRUMS.**

MORE THAN

**300 STATION METERS,**

Varying in size from 1200 to 200,000 cubic feet per hour, have been sold, fitted with

*THREE-PARTITION DRUMS,*

Since their introduction.

**ROUND METERS as above are kept in Stock in all Sizes ready to send away at the shortest notice. Compact, portable, and very easily fixed. An Improved Overflow Water-line Regulator fitted to every Meter.**

**DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.**

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Telegraphic Address: "GAS-METERS."

OFFICE: 10, MAWSON'S CHAMBERS, DEANSGATE,
**MANCHESTER.**
Telegraphic Address: "PRECISION."

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## TO CORRESPONDENTS.

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THE

# JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, OCTOBER 28, 1890.*


### The Labour Topics of the Past Week.

It is vain to hope that we can get away from the discussion of labour questions, while it remains impossible to forecast from one week to another the turn that industrial problems will take. During the past week much has transpired to rivet attention upon these matters. The most serious incident was the disclosure by *The Times* of the fact that the practicability of a general lay-up of vessels in British ports had been inquired into by the newly-formed Shipowners' Federation. Though the truth of this report has been denied, it is believed that there is something in it; and the mere notion that such a suspension of the carrying trade of the United Kingdom—which is as much as to say of the world—is even contemplated as a distant possibility, has been sufficient to cause the community to lend a more attentive ear to complaints of the conduct of the Unions connected with shipping. If anything had been needed to strengthen the suspicion that the associated shipowners mean business in this matter, it has been supplied by the announcement that the London Dock Trust intend to make an effort to overthrow the supremacy of the Dockers' Union, to which they have been subject for just a year—a feat they would hardly attempt unless some arrangement had been made for uniting the interests of the different orders of employers likely to be affected by this proceeding. The shipping interest has learnt something during the year that has passed since the dockers' strike; and so have the public. The only people who do not seem to have acquired wisdom in the interval are the Unionists. They have apparently pushed their unfamiliar advantage to the breaking-point. They have exacted whatever rates of pay they chose to think were their due. Foremen, weighers, clerks, watchers have been wholly at their mercy. No overlooker dared report a Union man for idling, bad conduct, wilfully damaging property, or petty thieving, on pain of losing his livelihood. The Union men have claimed the right to work when they liked, how they liked, and for what they liked. Steamships have been kept idle at the wharves, and cargoes have been exposed to damage and waste, at the men's will; while the latter spent in drink the high wages they had earned by overpaid spasmodic labour. Again and again the nominal chiefs of the Union have been invoked to bring their supporters to a sense of duty; and these, recognizing the danger to the organization of conduct such as was proved against the men, have ordered, advised, and implored them to work on the employers' terms. These self-appointed leaders of a Union which is only a mob have found, however, that it is easier to raise a devil than to rule him. Whenever they undertook to insist on more money, shorter hours, or anything else for the benefit of the men, the latter were models of docility. But the moment the leaders essay to exert the slightest disciplinary power, they are jeered at, and their authority is ignored.

This sort of thing cannot possibly be permitted to last. The Dock Trust have notified their intention to enrol free labourers; to disestablish the Union overlookers; and, while not excluding Union men, to ignore the distinction between them and freemen. Meanwhile, certain shipowners and merchants have taken pains to keep the general public informed of the reasons for this deposition of the Union, in order that if the alteration of the system of working at the docks should be the signal for a strike, the sympathy and support of outsiders may not be captured by demagogues, as was the case last year. If, after all that has been published illustrative of the manner in which the Union has abused its opportunity, the dockers strike against the attempt of the employers to resume the control of their own business, they will hardly receive such help from notoriety-loving "mediators" as they did a year ago. The public then sympathized with the dockers in their desire to improve the conditions of their employment, and to relieve the docks of the reproach of creating more misery than could be relieved by the system of scrambling for work which had there become established. The Dock Directors shut their eyes to the evils of this system, which was convenient to them in many ways; and they made no effort to set themselves right with the public until it was too late. All this has been altered since the Dockers' Union, that was to do so much for its members and for the employers also, has chiefly succeeded in demonstrating once more the truth of the old proverb about the conduct of a beggar on horseback.

The Eccles election has brought the Eight Hours Bil into prominence, owing to this cause having been made a test question between the candidates. How far the acceptance by the candidate who was eventually elected of the pledge proposed to him by the miners (who form a conspicuous portion of the constituency, and who made the Eight Hour cause their own), influenced the result, is not for us to say. It is impossible to avoid commenting upon the subject of this election, because it was the first in which this particular tenet of Socialistic Trades Unionism has been a test question. But we are not

disposed to discuss the matter at any length, especially as even Mr. Gladstone has since taken an opportunity of laying stress upon the difference between a miners' eight-hour shift and a legislative eight-hour day for all trades. That this distinction should have been drawn by Mr. Gladstone in his West-Calder speech is a welcome sign that, up to the present time at least, the leader of the political party which includes Mr. John Morley and Mr. Michael Davitt, supports in industrial matters the views of the former in opposition to those of the latter section-leader.

The mention of Mr. Michael Davitt suggests a remark upon his new journal, the *Labour World*, which has reached its sixth number. We have long sought the accepted and reliable "organ" of the new labour party, with a view to learning what might be going on among the class that affects to consider itself not only master of the world, but also the only order of humanity deserving of continued existence. Surely, we have thought, such an important cause as that of Organized Labour must have an "organ" by which its announcements and proceedings are published, and in which its friends and enemies receive due attention. Ordinary newspapers are filled with so many different matters, that they cannot afford the Labour Party all the scope it must require for the disclosure of its mighty designs; wherefore there must be, as one would naturally think, a special newspaper devoted to the purpose. Indeed, seeing what numbers and varieties of causes, great and small, have "organs" in this age of newspapers, we should not have been much surprised if the Gas Workers' Union alone, with its supposed membership of 100,000 and upwards, required a news sheet all to itself. It appears, however, that whatever else the organized labourers can do, they cannot conduct a newspaper of their own. They have no articulate voice, even if they have any further policy to proclaim than that expressed in the familiar lines descriptive of the "Four Eights," which, as we have seen in Australia, are not quite enough to make the working men happy. The Socialists, on the contrary, about a year ago had a grand programme, and any amount of voice; but they were like those who cry in the wilderness —they had no public. The immediate result of the coalition between the Socialists and the Labour Party was that the one side contributed the tongue and the other the multitude; and from this combination resulted the New Unionism. Mr. Champion had a little journal, the *Labour Elector*, which pretended for awhile to lead the New Unionist movement; but it never had any news, being usually at least a fortnight behind the times. The American-Irish political party, however, essayed to make organized labour captive. But Mr. Champion did not admire this party or its favoured journalists; and when one of them was sent to jail for a peculiarly disgusting offence, he spoke his mind about it, which resulted in the withdrawal of the support necessary for the existence of his poor little paper. Then Thorne, De Mattos, and a few others, started the *Labour Press;* but this publication has never been worth the penny charged for it. It never gives any but the stalest news as to labour questions; many of the most interesting matters of this kind it never mentions at all; and, for the rest, fills up with cheap extracts from Socialistic writers and American "humourists." Now Mr. Michael Davitt has made an attempt to supply the want with a voice that, while crying "Labour" to a certain extent, is fonder of shouting the Irish politics in which he fancies the British workman takes an absorbing interest. As we have already declared, we believe that the British workman only really cares for one thing; and there is no reason to suppose that he is partial to Socialism, Fenianism, Teetotalism, or any other "ism," beyond being willing to make use of their professors to advance his cause. Altogether, and notwithstanding Mr. Davitt's adventure, we continue in search of the voice of the uncontaminated labour interest, apart from the pronouncements which Thorne, Ward, and Co. send to the JOURNAL, and the speeches uttered by them which are reported from time to time in the newspapers. What these are worth is open to anybody to judge.

### Mr. Livesey and His Enemies.

IT is not the least striking of Mr. George Livesey's qualities that he is continually doing things that tend to lash his enemies into impotent fury. Ever since his powerful individuality startled the routineers of the gas industry, he has had his detractors; and he will probably be dogged by others so long as he retains the capacity for doing such strong and original work as that with which he has so often impressed the community. A year or so ago, certain short-sighted persons went about proclaiming that Mr. Livesey's influence on the gas industry was definitely extinguished, and that nothing he could say or do for the remainder of his life would be worth anybody's notice. Then came the trouble with the stokers; and Mr. Livesey loomed larger than ever in the eye of the world. By the time this historic conflict was over, Mr. Livesey's name was a household word in the mouths of millions who had previously never heard it. This was perfectly natural in the circumstances; but it was very disappointing to those who had flattered themselves that a series of dirty actions on the part of others, directed at Mr. Livesey, had effectually reduced him to a negligible quantity. With the rise of his renown in connection with the defeat of the South Metropolitan strike, Mr. Livesey passed beyond the reach of one gang of vilifiers, only to receive the honour of unmeasured abuse from others. That flower of the New Journalism, the *Star*, in its calculated catering for the labour vote, has bestowed upon him all the richest of its Irish-American scurrility. According to this respectable print, nothing that Mr. Livesey does can possibly be right. He did not fill the cup of his iniquities, however, until he presented a library to his parish of Camberwell, and, in dedicating it to the people, remarked that "God having prospered him, and having received much "kindness from the working people, he felt it a duty to do "something to brighten their lives; and he thought that "could best be done by the establishment of a Free "Public Library." The "unblushing villainy" of this conduct is too much for the virtuous *Star*, which accordingly explodes in hysterical denunciations of it. This outburst serves to introduce the subject of the recent issue of South Metropolitan "C" stock to the gas consumers in the Company's district, in which it appears a "*Star* "man" happens to live. (It may be parenthetically remarked that this experiment has been a great success; upwards of £10,000 worth of stock being taken, and more asked for.) It is hinted that Mr. Livesey had some deep design in including the reporter in the general offer of "C" stock at 242; but we are assured that the offer is not appreciated in this influential quarter. The reporter would evidently give a good deal to be able to pick a hole in this latest South Metropolitan scheme; but he cannot find a thin place in it, and is obliged to subside with a grudging expression of acknowledgment of Mr. Livesey's "astuteness." It is wonderful, indeed, when the worst that the *Star* can allege against the object of its pet aversion—whom it has abused, misrepresented, and jeered at in the fashion which has won it a great and deserved success as the most popular gutter-newspaper of the day—is that he is a "shrewd practitioner." At this rate it may be supposed that the *Star* is growing tired of "throwing mud" at Mr. Livesey, as others have done before when they found it could not be made to stick. Mr. Livesey's friends would, of course, be well pleased if these wretched prints were to stop their attempts to drag the name of the Chairman of the South Metropolitan Gas Company in the dust; for it is not agreeable to read such aspersions (even when ludicrously ill-founded) upon a man held in such respect. There is one thing that they would regard as a greater misfortune, however, and that is the conversion of these ineffectual foes into apologists and partisans, which might be done with small trouble and at no great expense. The adulation of some people is a greater insult than their abuse.

### The Final Report on Lighthouse Illuminants.

AT length it may be hoped that the weary discussions about lighthouse illuminants can be said to have been satisfactorily ended. Just two years have elapsed since it was confided to Sir George Stokes, President of the Royal Society, and two other members of this eminent body, to determine whether the South Foreland lighthouse experiments bore out the conclusion of the Trinity House report, that for ordinary purposes mineral oil, and for exceptional powers electricity, are the best illuminants. This conclusion, it will be remembered, was traversed by Mr. Wigham, who maintained that by it coal gas was unduly disparaged, to the detriment of the lighthouse service. In the inquiry, Sir G. Stokes was associated with Lord

Rayleigh and Sir W. Thomson; and beyond these three authorities in physical science there can be no court of appeal. Their report is a model of judicious expression. They seem to have taken account of everything. Some of Mr. Wigham's less reasonable contentions they dismissed. But they have gone with him so far as to say that they see no reason why the choice of a light should be confined to mineral oil and electricity; and that as there may be special reasons in particular cases for giving the preference to gas, it is desirable that mariners should have the opportunity of witnessing the effects of different systems, which would thereby be subjected to the test of long-continued practical experience. This conclusion completely satisfies Mr. Wigham.

**The Management of Papers by Technical Societies.**

REFERRING to the recent combined meetings of the Iron and Steel Institute and the American Institute of Mining Engineers, the *Engineering and Building Record* remarks that for the first time, at any rate in the history of the American Society, printed copies of the papers were circulated in advance of the readings in meeting. Although this is hailed as a decided step in advance of the customary practice, it is pointed out that something more is needed in order to prepare those who attend meetings of technical societies where papers are read, to take part in those full and authoritative discussions which are being increasingly recognized as the most useful portion of the Transactions of such societies. With the exception of those papers which are really lectures, and those which, from their statistical or other dusty nature, do not invite debate, the discussion of a paper ought to be as useful as the paper itself. This cannot be the case when speakers have to discuss the author's statements on the spur of the moment. Even distributing prints at the time does not quite remove the difficulty. In view of this consideration, and also of the fact that most papers contain some matter that may be better taken as read, the American Society of Mechanical Engineers several years ago adopted the plan of printing and distributing their papers several days in advance among members desiring copies. A fair opportunity is thus afforded for study of the subject, and for the preparation of written comments at members' discretion. At the meeting, the author of the paper does not read it in full, but only gives an abstract, to take up not more than ten minutes; and in the resulting discussion, each speaker is limited to five minutes. For written discussions (which may, of course, be read in the writer's absence, if necessary), ten minutes are allowed; and the author has five minutes for his reply. This latter restriction appears to be rather severe. Our American contemporary avers that the advantages of the system have been most strikingly demonstrated. The sessions of the Society present a most business-like aspect; and a vast amount of work is got through with ease in a short time. The attention of members of District Associations of Gas Managers may be directed to this arrangement, as it seems calculated to obviate the necessity of deferred discussions, which are commonly failures. It is practically impossible to warm up the interest of a meeting in a matter that was broached six or even three months before; and if safeguards are taken against premature publication, it would appear that the plan of the American Society of Mechanical Engineers must be peculiarly suitable for small Associations only meeting for a portion of a day.

**Mr. Cripps's Reply to Mr. Gadd.**—Doubtless many of our readers have been expecting the promised rejoinder, by Mr. F. S. Cripps, to Mr. Gadd's review of his criticism of the paper read by the latter gentleman at the last meeting of The Gas Institute. We may therefore state that the first portion of Mr. Cripps's reply is in type, and has been revised by him; but we are unable to find room for it in the present issue of the JOURNAL.

**Mr. Ellis Lever's Appeal.**—The appeal of Mr. Ellis Lever against the decision of Justices Denman, Charles, and Vaughan Williams, refusing to grant a new trial of the action tried by Mr. Justice Day at Leeds (see *ante*, p. 36), was in the list of cases to come before the Master of the Rolls and Lords Justices Lindley and Lopes, in Appeal Court No. 1, yesterday; but it had not been reached at the rising of the Court.

**Death of Mr. J. Bradley, of Fylde.**—At the half-yearly meeting of the Fylde Water Company last Thursday, reference was made to the death, on the previous day, of Mr. John Bradley, who for the past 24 years had filled the position of Secretary of the Company. A vote of condolence with the family was passed, and Mr. Bradley's long service with the Company duly recognized. He was in his 72nd year.

## WATER AND SANITARY AFFAIRS.

THE City of London Corporation having adopted the report of their County Purposes Committee with respect to the water supply, the subject now becomes invested with greater importance. A somewhat singular communication has been addressed to the Corporation by the London County Council, proposing that the two bodies shall unite in the promotion of a Bill for revising the methods by which the Water Companies are now charging on the basis of the rateable value of the property supplied, and for giving power to the County Council and the Corporation to establish an independent supply "to the "county of London." The letter conveying this proposal also stated that the County Council had authorized their Special Water Committee to enter into tentative negotiations with the Water Companies, for the purpose of ascertaining on what terms the Companies would be prepared to dispose of their various undertakings, in the event of Parliament giving power to the County Council to acquire such property. This communication having been read in the Court of Common Council, was referred to the County Purposes Committee to consider and report. We do not know what the civic body may have to say to the matter; but it seems to us that the County Council are trying to make a very pretty tool of the Corporation. If the Joint Bill is agreed to, the County Council will be able to hold it up *in terrorem* to the Water Companies, so as to get easy terms of purchase; such purchase being for the purpose of transferring the supply to the County Council. If this be not the design, the letter should have been differently expressed. We should also like to know why the Corporation are simply invited to co-operate with regard to "the county of London." There is at the same time a rumour, which we give for what it is worth, that a Bill is to be brought forward conferring on the London County Council, or a public body to be called the London Water Trust, such rights and compulsory powers as may be necessary for provision to raise money required for the purchase of the existing London Water Companies. Except that we miss the proposal for a competing supply, this looks very much like the Bill which the Vestries were to support by contributions of £10 each, at the suggestion of Mr. James Beal and the Vestry of St. James, Westminster. But, putting aside this rumour, and limiting our attention to that which is overtly official, there is something highly diplomatic in the suggestion that the Corporation shall join the County Council in an attempt to limit the water charge, and to introduce an independent supply. The latter is a proposal which the County Council could not make before Parliament if standing alone; and, if made, the Corporation will have to bear the cost. How these two great bodies may manage to settle their differences, we can scarcely anticipate. The Corporation scheme is for a representative Water Authority, in which the Corporation, the Council, and the Local Authorities outside the Metropolitan boundary, but within the area of the supply, shall all be duly represented. This is fair; and if the County Council fall in with it, it will be because they feel that nothing less will have a chance of success.

The price to be paid for the undertakings of the Water Companies gives rise to a great conflict of opinion, although the facts are plain enough. A net income, not far short of £1,000,000 per annum, has to be bought up. What shall be paid for it? There is no need to go to the Stock Exchange in order to find out. Neither is the question to be settled by reckoning what would be the cost of beginning *de novo*, and establishing other works. The present income of the Metropolitan Water Companies is a perfectly legal one, and to substitute a lesser amount would be simple robbery, or even something worse, for it would show that statutory rights were as insecure as the foundation of a commercial undertaking. Elsewhere we give an extended abstract of a long article in the *Financial News* concerning the acquisition of the water supply. The strange remark of Sir John Lubbock, that the purchase of the undertakings would throw an extra 4d. in the pound on the rates, is shown to be without warrant. An estimate, prepared at the instance of the *Financial News* by Messrs. Mathieson and Sons, works out a total value for the water undertakings very nearly the same as that given in evidence before the Corporation

Committee by Mr. Samuel Wood, and slightly in excess of it. The idea of a loan at 3 per cent. so as to purchase the property is set aside as a dearer way of raising money than need be entertained. Interest at 2½ per cent. is considered practicable, with repayment in an average period of 56 years. The conclusion arrived at is that the County Council would have no difficulty whatever in dealing with the whole financial question without inflicting any additional burden upon the ratepayers. In order to include the provision of a sinking fund, our contemporary reckons on a loan to the extent of £36,506,176, and an annual charge of £1,216,891. The latter amount is quoted as the net revenue of the Companies at the present time. There appears to be some mistake here, as the net income last year did not exceed £940,000. It also appears to us that due allowance is not made for the surplus income that would accrue from year to year, according as the capital was paid off. This would be so much to the good, and would materially assist the transaction. Without entering into any niceties of calculation, it is certain that a public authority can raise money on such terms as will provide for the equitable purchase of the water undertakings, and for the liquidation of the capital within a reasonable period, without imposing any fresh burden on the public rates.

Our latest information, coming down to the close of yesterday, is that some correspondence has recently passed between the London County Council and the Water Companies, in pursuance of the water clause in the General Powers Act. The last communication from the Council was to the effect that they were about to hold an inquiry into the subject of the water supply, and that the Companies were offered the opportunity of appearing and giving evidence. On this proposition, the Companies, as represented by their several Chairmen, instructed from the Boards of Directors, have not yet deliberated, and consequently no reply has been sent. We understand that the first communication from the Council differed somewhat from that which followed it, inasmuch as it asked the Companies whether they were prepared to consider an offer, if made to them, for the transfer of their undertakings. The Companies, we believe, replied that if such an offer were made to them they would give it consideration. So far as a lump sum is concerned, the amount suggested in the report of the Corporation Committee—namely, £33,444,506—is evidently considered by the Companies to be insufficient as compensation to the shareholders. The latter would lose by the bargain.

We cannot conclude our present remarks without calling the attention of our readers to an excellent letter addressed to us by Mr. E. K. Burstal, M. Inst. C.E., which will be found in our "Correspondence" columns. Mr. Burstal effectually controverts sundry statements made before the Corporation Committee during the recent "inquiry," especially in regard to the evidence of Mr. Jabez Hogg and Mr. E. Archibald Dobbs. It is a little amusing to read that on four out of the five occasions on which our correspondent was present at the proceedings of the Committee, he was the sole representative of "the "public;" and on the fifth, there was simply one other besides himself to form the audience. So far as the presence of the public was concerned, it would seem that the "general consensus of opinion" was rather weak. Another matter of interest consists of a letter to *The Times*, signed "Engineer." We might make a fair guess as to the personal identity of this gentleman; but we are more concerned with his proposition, which is that the entire water supply for six millions of people shall be brought from Wales to London in a pipe of sheet iron or mild steel, 10 feet in diameter, a little over ½ inch thick, and 180 miles long. It is to be hoped that the capital of the kingdom will never be made to depend for its water supply on the tender mercies of such a scheme as this. A single fracture, and where would the water be?

F. **"Paper" Gas-Pipes.**—It is reported that "paper" pipes, for distributing gas in buildings, are finding favour in Philadelphia. The pipes are composed of strips of manilla paper, equal in width to the length of the pipe to be made; the paper being placed in a bath of asphalte. It is then wrapped firmly and evenly round an iron core until the required thickness is obtained. The pipe is afterwards subjected to a heavy pressure, after which the exterior is sanded, and the pipe bathed in water. The core is then removed, and the interior coated with a waterproof composition.

## ESSAYS, COMMENTARIES, AND REVIEWS.

### GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 911.)

THE Stock Exchange naturally continues in a very agitated condition, and it must so remain until after the settlement this week. Prices are still kept down, and some are even lower—owing to forced realizations, and stock thrown upon a market where there is no demand for it. Jobbers are overstocked, and buyers are shy. It is an illustration how strongly confidence has been shaken, that, although everyone admits that at current prices buyers must do well in the long run, yet they do not come forward. Fortunately, the Bank-rate was not raised on Thursday, or the difficulties of the period might have been sorely aggravated. Business in the Gas Market was pretty brisk in the earlier part of the week; but it tailed off very quiet later on. Movements in price have been somewhat irregular; but, on the whole, the tendency is rather flat. This is not to be wondered at, seeing how everything has drooped. Gaslight "A" started well—keeping up the strength with which it closed the Saturday before; and soon it improved its quotation by 1, with business marked at 239. But it fell back to the old price at the close; and stock changed hands at 236½. Very little was done in the secured and limited issues, and prices were not remarkable. In South Metropolitans, some "B" was bought on Monday at fair figures; but nothing more was done all the rest of the week. Commercials were not touched at all. An unusual amount of business was done in British, at good average prices; but none of the other Surburban and Provincial undertakings attracted any notice. The Foreign division presents the only cases of variation in quotations; and all changes are for the worse. Continental Unions have eased down after their free advance; and the selling price is 1 lower. Imperial Continental has changed hands a good deal; and the price commanded in the market might justify a rather lower quotation. The East Indian undertakings are looking rather disposed to improve slightly. South Americans tend the other way. Monte Video and Pará are each ½ lower; but St. Paulo is very steady. Australians are going at easy prices. The Water department has been quite brisk. Nearly all issues are lively, at improved prices—undismayed by any fear that the State will lay violent hands upon them.

The daily operation were: An active opening in the Gas department on Monday, with a good show of firmness all round. Prices of almost everything were up to the average; but quotations did not move. In Water, Lambeth rose 1.; and East London debenture, 2. Business was rather quieter on Tuesday; but prices kept up. Gaslight "A" rose 1. In Water, Lambeth advanced 2; East London and Grand Junction, 1½; and Chelsea and Kent, 1. Wednesday's business was much the same as Tuesday's; and all prices were good. East London Water rose 1 more. Thursday was very quiet—hardly any business being done in Gas. Continental Union, fully paid, fell ½. Friday's transactions, too, were very limited. Monte Video receded ½. The only feature of Saturday was the weakness of Gaslight "A," which lost the advance of 1 it had gained on Tuesday.

### ELECTRIC LIGHTING MEMORANDA.

**The Liability of Accumulators to Explode—The Corporation of Leeds and their Electric Lighting Experiences—Primary Battery Lighting.**

ONE of the most noteworthy of the incidents of the week in connection with electric lighting is in some respects a very small matter. It is small, that is to say, in itself; and is yet of considerable importance for what it illustrates and implies. A steam yacht—the *Pathfinder*, owned by Earl Poulett—while lying in Portsmouth Harbour, was the scene of an alarming explosion. The vessel is lighted throughout by electricity; the generating machinery being supplemented by accumulators in order that the dynamo and engine need not be kept at work for the maintenance of a few of the lights. Formerly the accumulators were stowed in the coal bunkers; but this being out of the way, they were this season placed on deck, enclosed in a weather-tight box, which was supposed to be ventilated. During a rainstorm, water trickled into one of the cabins below through a hole made for the passage of a wire from the dynamo to the accumulators. Upon Earl Poulett striking a light to look for the leak, the cabin being rather dark, a violent gas explosion occurred, which shook the yacht from stem to stern, and blew the accumulators and their casing into the air. The most remarkable part of the story is that the dynamo was running at the time, and only ten minutes before the explosion Earl Poulett and his engineer had had the accumulator box open in order to see how the cells were working. How the gas could have gathered in such dangerous quantity, and in so short a time, is therefore a great mystery. The affair has naturally affected the general opinion of accumulators, which have always been regarded as perfectly harmless provided that reasonable means of escape are arranged for the small quantity of gas resulting from local action, which is usually quite insignificant. We notice that one or two electricians have rushed into print with explanations to the effect that the accident should not be put down to the lighting, as it was due to something going wrong with a subsidiary appliance. Those who are interested in accumulators will be very unwise if they permit the matter to

rest here, however. The incident must be cleared up; for accumulators have quite sufficient burden to carry in their high cost, without incurring the additional great reproach of being dangerous.

Local self-government is a grand thing in the abstract, and it works passably on the whole; but here and there its practical execution leaves much to be desired. The Corporation of Leeds, for example, are scarcely a pattern for business capacity to other municipal authorities. A local newspaper has recently been engaged in raking Corporation doings into the light of day; and some of these certainly do not very well bear the ordeal. The critic declares that "no question tackled by the Corporation in recent years more forcibly illustrates the huckstering, shilly-shally policy of that body than that of electric lighting." Five or six years, we are told, have now been spent in "inquiring," "reporting," "experimenting," and "debating;" and the upshot of all this fuss is nothing, or something that may turn out to be worse than nothing. Upwards of £15,327 has been spent, for which the Town Hall and the Municipal Buildings have been illuminated, "or partially so," by electricity; and this is all there is to be seen for the money. The plant that has cost upwards of £15,000 represents perhaps £5000 of actual value; so that the Corporation have dropped at least £10,000 in the abortive attempt to forestall the electric light companies, and have only succeeded in supplying the latter with a splendid argument against corporations meddling in the business.

There seems to be some demand for a convenient primary battery for electric lighting which is not supplied by any device yet known in the market. Project after project of this class is brought forward, only to disappear immediately after half a score of electrical experts and their journalistic satellites have warmly testified to its qualities. The last of the order is the Vaughan-Sherrin battery, in which zinc is acted upon by a liquid of secret composition. Makers of these batteries know full well that it is impossible for them to disguise the fact that zinc is the fuel which they must consume in the cells; and so they are driven to deceive the public, if they can, in regard to the active fluid which is employed to dissolve the zinc. Professor Silvanus Thompson has reported on the working of the Vaughan-Sherrin battery, to the effect that it is capable of yielding a Board of Trade unit of electrical energy for about 9d. or 10d. This assertion has brought several specialists down upon the Professor, among others M. Hospitalier, who points out that in the production of the stated quantity of electricity, the battery consumes about a kilogramme of zinc, the expense of which cannot be less than 6½d. It follows from this that the cost of the secretly compounded fluid which dissolves this weight of metal cannot be more than 3½d., which is almost impossibly low. Notwithstanding all the discredit that specialists and speculators have brought upon the idea of lighting by primary batteries, we are not at all sure that a certain amount of business might not be done in this way by a practical electrician, especially for country houses. But there should be no pretence about the battery, or the fluid, or anything else. It would be only a question of fitting up a few drawing-room lamps to replace troublesome oil or expensive candles, and serving these from a battery in an outhouse. If the total initial outlay for such a purpose were not prohibitory, it is at least possible that a good many country residents would not mind the cost of the zinc and common chemicals required for serving half-a-dozen 10-candle power lamps for two or three hours daily, provided that the management of the battery did not involve too much trouble or need skilled attention. A few amateurs have provided themselves with electric lighting in this way; but there is practically no trade in it, and perhaps we exaggerate the prospect of anything of the kind.

## A GERMAN TREATISE ON GAS-ENGINES.

The favourable reception of the first edition of Herr Schöttler's treatise on gas-engines, induced the author to accede to his publisher's proposal for the preparation of a second;* for although, as he states, there is just as little complete and conclusive material to offer the reader at the present time as there was seven years ago, yet the construction of gas-engines has improved formidably during that period. For instance, the celebrated Deutz factory has developed the "Otto" engine with much skill and success; having manufactured it in the most varied forms in order to render it suitable for the requirements of all departments of industry. Other firms have, on their own account, also utilized the Otto discoveries, as well as endeavoured to attain progress in other directions; and, as the author remarks, even if perfectly satisfactory results have not yet been arrived at, this struggle to attain perfection is in itself captivating and instructive, while the results which have been obtained, so far, are themselves worthy of consideration. Moreover, the gas-engine has attracted much scientific attention; and although even here no absolutely definite conclusions have been reached, much progress has been made in the knowledge of the nature of the gas-engine, many valuable suggestions have been thrown out, and a number of false views have been set aside. The collecting together in the present volume of all this progress in our knowledge and experience of gas-engines, necessitated on the part of the author a new mode of dealing with the subject; and he has adopted the historical development as a basis, instead of dissecting the engines, and discussing their construction from the individual parts, as would be done in a treatise on steam-engines. This difference in treatment is justified by the comparative youth of this class of engine. With regard to the thermo-dynamical section of the book, this has again been wisely included; and it will be found convenient by many readers to have these matters summarized and at hand for future use, while those who are conversant with the thermo-dynamical theories, and are accustomed to make use of them, will soon run through that section, and scarcely remark the fact that the book is a few pages thicker than it would otherwise have been.

Turning now to the treatment of the matter, the book starts with an introduction in which are set forth the fundamental principles of the gas-engine, such as the behaviour of various mixtures of air and gas as regards exploding, burning, or being non-inflammable; considerations influencing the proportions of these gases suitable for working gas-engines; the significance of cooling; the relegation of gas-engines to direct-acting or to air engines, according to the manner of rendering the power available, &c. A historical *résumé* is next given, in which we are told, as usual, that the earliest form of engine to be worked by explosions was the powder-engine proposed by Abbé Hautefeuille in 1678; but that Huyghens, in 1680, was first to use a cylinder and piston; and that the next movement in this class of invention was made in 1791 by John Barber, who was followed in 1794 by Robert Street. Their engines, however, were very imperfectly designed. Other inventors followed; Lebon (1801) being the first to employ gas as now applied. Then the inventions of Brown in 1823, Wright in 1833, and Barnett in 1838, are mentioned; and a host of other patentees are alluded to generally. But the engines are all regarded as inefficient. The author then remarks that Lenoir, in 1860, introduced a useful form of gas-engine; but that successful impulse to the progress of this kind of motor was given in 1867 by Otto, who, we are informed, united various useless, and even forgotten, discoveries into one harmonious and useful whole, culminating in the well-known engine bearing his name, which, the author states, has not only had an extraordinary and prolonged success, but has also not been surpassed, although there have been numerous discoveries since, many of which are of interest.

The historical *résumé* is followed by a detailed account of the more notable and practically efficient engines, giving particulars of their construction, modes of working, efficiency, and financial value; drawings in most cases accompanying the letter-press description. For convenience, these descriptions of the engines are arranged under their various heads, as follows: (1) Direct-acting engines, without compression of the charge, such as Lenoir's, Ravel's, the Economic Motor Company's engines, &c. (2) Air-engines, such as the Barsanti and Matteucci, and the original form of the Otto and Langen engine, &c. (3) Four-stroke explosion engines, such as the Otto, Sombart's, Adam's, &c. (4) Explosion engines, working with compression of charge, but not four-stroke engines, such as the Beck, the Griffin, the Wittig and Hees, Clerk's, Atkinson's, &c. (5) Combustion engines, in which the mixture of gases is made outside and is burnt as it enters the cylinder, such as Brayton's, Simon's, &c. In the chapter dealing with the four-stroke engines, there is description of the manufacture of Dowson gas and its cost; while the benzene engine of the Deutz Company, and Spiel's petroleum engine, also find a place in that chapter.

Other chapters deal with the following subjects: The physical effect of heat on gases; thermo-dynamical theories; constants for preparing mixtures of coal gas and air; cycles of the various gas-engines; heat measurements in gas-engines; combustion in gas-engines; the effect of the acceptance of variable specific heat on the calculations. There are added a list of German patents for gas-engines up to June 30, 1889, and a bibliography of the more important contributions to gas-engine literature. The thermo-dynamical and other physical points are well presented, with ample illustrations, both diagrammatic and numerical, in the first three of these chapters. With regard to the cycles of gas-engines, the author deplores the uncertainty surrounding this branch of the subject; and in order to provide information which will serve to indicate to some extent the circumstances influencing the results, and the direction in which they act, he presents to his readers in the next chapter ideal cycles, in which the detracting and unsatisfactory factor of the various gas-engines—the cooling—is not taken into consideration. The next chapter, which terminates with a table of comparative heat accounts of the Beck, Griffin, Atkinson, and Otto engines, also deals with the manner of making calorimetric observations with the gas-engine, and Rankine's, Weyrauch's, Ayrton and Perry's, and Zeuner's methods are described, as regards both their origin and application.

The succeeding chapter contains an excellent digest of the various views and experiments that have been brought to bear on the "retarded contraction phenomenon." Writing generally as to the sources of heat possibly contributing to this phenomenon, the author states that recent experiments have led him to the conclusion already expressed casually by others—that a

* "Gas-Engines: Their Development, Present Mode of Construction, and Cycles of Operations." By R. Schöttler, Professor at the Ducal Technical High School, Brunswick. Second edition, completely remodelled, with 250 illustrations. Brunswick: Benno Goeritz; 1890.

reflux of heat may take place *from* the uncooled surfaces of the cylinder, especially from the piston, which surfaces may in some way act as compensators, by accumulating heat at the higher temperatures, and giving it out again while the temperature is falling. This does not, however, dispel the theories based on "retarded combustion," as both agents could exert their influence simultaneously. Turning to the different explanations of the phenomenon which have been offered, the author gives a digest of the various statements, observations, and experiments which have been made in favour of, and in opposition to each of them; finally summing up and giving his views on the point. With regard to the "Otto" or "layer," or, as the author suggests as a better name, the "dissimilar character of the charge" explanation, after a due consideration of the old and new evidence, the author concludes, and apparently with full justification, that although the condition of the charge may be cloudy throughout, there is not really any such condition as is claimed by Otto; that such a state of things is not the cause of the retarded fall in pressure; that a dissimilar character of the charge is not necessarily associated with the absence of bumping; and therefore that this explanation has collapsed. The "dissociation" explanation is also shown to be untenable, as the phenomenon occurs where dissociation is impossible. The "surface influence" theory championed by Witz, and contested by Slaby, in both cases with almost unimpeachable experiments, has received very careful consideration at the hands of the author; and he considers that the principles deduced by the former, from his experiments, are applicable and must be applied to gas-engines, although in some engines other influences may step in and destroy the more beneficial "surface influences." Such interfering influences one should endeavour to remove. It is therefore recommended to burn quickly a mixture as poor in gas as possible, with the surfaces of the cylinder at as high a temperature as is permissible, with the most rapid piston stroke practicable. The author adds that it seems as if gas-engine makers ought to apply these principles throughout. The excellent results of the Atkinson engines are explained by them; but it must not be overlooked that a badly-built engine in which they are fully followed out would not stand against a well-built engine in which they were not so strictly applied. A fourth explanation, originating with Fliegner, suggests the separation of carbon; but, being highly improbable, this is not further considered. The chapter concludes with remarks on the influence of the dimensions of the ignition-tube on the combustion. This tube should be sufficiently large to conform with the rapidity of the stroke and the shape of the bottom of the cylinder. The final chapter and the addenda need no comment beyond the remark that they are useful in their way.

Altogether, Herr Schöttler's book as now issued is a much more thorough treatise on the gas-engine than was the first edition. Not only does it show improvement in the matter dealt with, but also in minor points, such as giving a table of contents and having the illustrations distributed throughout the work, in proximity to the letterpress descriptions to which they belong, instead of all being on sheets at the end of the book. It must be acknowledged that some engines which are now in the market are not mentioned; but others closely allied to them are described.

## WATER ACTS FOR 1890.

In the JOURNAL a fortnight ago we gave our usual abstract of the Gas Acts of the past session. The following Acts relating to water supply were also sanctioned by the Legislature:—

The Canterbury Gas and Water Act enables the Company to raise £15,000 of new water capital, to be called new "B" shares or stock, to carry an 8 per cent. ordinary or a 6 per cent. preference dividend, with the usual borrowing privileges. Power is granted to the Company to place to a water reserve fund a sum of £5750, being the residue of the amount now standing to the credit of the reserve fund after carrying an amount of £3500 to a gas reserve fund. The Company may supply water-fittings. The Higham and Hundred of Hoo Water Act incorporates a Company, with a capital of £28,000, and power to borrow £7000, for supplying water to a district in the neighbourhood of Rochester. The source of supply is to be a well and pumping-station in Higham parish, with a reservoir in the parish of Shorne. The land required for these works is to be taken within three years, and the works completed within five years. Rates for domestic supply are to range from 7½ to 5 per cent. on rateable value, with extras as usual. The Mid-Sussex Water Act dissolves and re-incorporates a limited Company formed in 1888 to supply, under a Provisional Order, a district round Hayward's Heath, Sussex, with a capital of £35,000. The capital of the Company is now fixed at £100,000, whereof £21,320 (being the nominal amount represented by old shares issued and fully or partly paid up) is divided into original £10 shares. Provision is made for dealing with half shares. The whole amount of £35,000 of the original capital of the limited Company is to carry a 10 per cent. dividend. The usual borrowing powers are conferred. An additional service reservoir is to be constructed in the parish of Cuckfield. Rates for domestic supply are to range from 7 to 5½ per cent., with 7½ per cent. for inns. Supplies by meter for other than domestic purposes are to be charged for at 1s. per 1000 gallons and upwards. The local authorities of the district may purchase the whole or any part of the undertaking. A schedule to the Act contains an agreement with a local landowner for supplying him with water in bulk as the consideration for his withdrawing opposition to the Bill in the House of Lords. The Airdrie and Coatbridge Water-Works Act sanctions certain emergency works executed by the Company in 1887, and confirms a districting agreement concluded by them with the Glasgow Water Commissioners. Power is given to enlarge and increase, as may be required, the mains and works of the Company other than reservoirs. The Burgh of Airdrie is to have a constant supply. Pipes outside the district are to be sold if necessary to the local authority. The Pontypool Gas and Water Act extends the limits of supply and enables the Company to raise £40,000 of new capital with the usual borrowing powers. An additional pumping-station, with duplicate machinery, is authorized, together with two reservoirs. The quantity of water to be taken from certain springs is limited; and the amount of compensation water is prescribed. In carrying out the Act, the Company are bound to provide within four years storeage to the extent of 6 million gallons; and to construct and utilize their new spring-water intake within two years. Separate gas and water accounts are to be kept. The Newcastle and Gateshead Water-Works Act enables the Company to raise £120,000 of new capital bearing a 5 per cent. dividend, with the usual borrowing powers. New pipe-lines and a new service-tank are authorized, to be completed within ten years. The South Lincolnshire Fen Water Act authorizes the transfer to the Company of the undertaking of the Spalding Water-Works Company. The terms of payment are: A sum of £500 already handed over; a similar sum within one month from the passing of the Act; a further cash payment of £20,110 on Jan. 6 next; and the discharge or assumption of the mortgage debt of £3400, with all interest as from Jan. 6 to the date of absolute transfer. All loose stock-in-trade is to be taken over at a valuation. The rate for water supplied in Spalding is to be 6 per cent. Power is taken to raise £20,000 of 5 per cent. capital, and to borrow an equal amount. The periods fixed by the Company's Act of 1888 for the completion of certain works are extended. The Ystrad Gas and Water Works Act enables the Company to raise £70,000 of new capital, with the usual proportion of loan, bearing a 7 per cent. dividend. Additional reservoirs on the Rhondda Fawr river are authorized, as well as some weirs across certain brooks, a new pumping-station, and other works, to be completed within seven years. Future water-rates are to be charged upon the rateable value of premises, instead of on the rack rent. The Ystrad Local Board may acquire the undertaking, if they elect to do so within six months from the passing of the Act; and the consequent dissolution of the Company is provided for. The terms of purchase are given in our summary of the gas portions of the Act.

The Birkenhead Corporation Gas and Water Act extends the period fixed for the completion of works authorized by an Act of 1881 to Jan. 1, 1902. Power is also given to agree with a certain landowner as to a variation of the height of the embankment of an authorized reservoir. Bidston is included in the water limits. When so required by the local authorities, the Corporation are to sell outlying portions of their undertaking. The Wallasey Local Board Act enables the Board to make bye-laws for the testing and stamping of water-fittings, compels the owner of cottage property to pay the water-rate instead of the tenant, and enables the Board to supply water in bulk outside their limits. The Baildon Local Board Water Act enables the Local Board to construct water-works, taking a supply from several brooks, and forming an impounding reservoir with provision of compensation water. The sum of £16,000 is to be raised for this purpose. Terms are inserted under which the Bingley Local Board may claim a supply for a portion of their district. The works are to be completed within ten years. Any deficiency in the water account is to be made good out of the district rate. The Bradford Corporation Water Act enables the Corporation to raise £1,230,000 for the purpose of water-works. Additional works, consisting of storeage and compensation reservoirs on a large scale, are to be constructed in the Nidd watershed. Provision is made for the protection of the numerous interests affected by these works. The Derby Corporation Act empowers the Corporation to raise £200,000 for water-works purposes. The limits of supply are extended; and new works, chiefly consisting of filter-tunnels and a pumping-station, are authorized to be completed within fifteen years. The Dewbury and Heckmondwike Water Act extends by ten years the time fixed in an Act of 1876 for the construction of certain water-works. Power is given to supply water in bulk to outlying local authorities. Neighbouring water-supplying corporations are protected. The Huddersfield Corporation Water-Works Act is to vest in the Corporation the undertaking of the Wessenden Commissioners, for which a consideration of £50,000 is to be paid. The application of this money is for the compensation of persons interested in the Falls of the Wessenden Brook. Additional works, comprising a storeage reservoir and several pipe-lines, are authorized. The supply of water for trade purposes from the Huddersfield Canal is to be stopped. Power is given to borrow such money as may be found to be required for the construction of the authorized works. The Leicester Corporation Water-Works Act extends the limits of supply, and enables the Corporation to raise £320,000

in all for water-works purposes. The works are to be enlarged by the construction of a reservoir on the Swithland Brook, a pumping-station, and the necessary subsidiary works. The Liverpool Corporation Act defers the commencement of the water account sinking fund until Aug. 6, 1895. Water charges in the borough of Bootle are assimilated to those in force in the city of Liverpool. The Morley Corporation Water Act enables the Corporation to borrow £100,000 and to enlarge their water-works by an impounding reservoir across the Withens Clough. The bulk of the Act is occupied with protection clauses. The supply is to be laid on constantly under pressure; and the rates for domestic supply range from 12 to 6 per cent. The Stockton and Middlesbrough Water-Works Act amends the statutes relating to the water supply of the district, reviving certain lapsed powers for the purchase of land, and authorizing the construction of new works, chiefly filters, and deviations of pipe-lines already sanctioned. There is an increase in the quantity of water that may be temporarily taken from the River Tees, from 66 to 70 million gallons. The Board have paid £1250 for the construction of fish passes. There is a clause dealing with the payment of interest on money sunk in unfinished works. The borrowing powers for water-works purposes of the Corporations of Stockton and Middlesbrough are enlarged to £163,450 and £196,140 respectively; and the South Stockton Local Board may borrow £32,690. The Warrington Extension and Water Act provides for vesting in the Corporation the undertaking of the Warrington Water-Works Company. This purchase is to be completed as soon as possible after July 1, 1891. The consideration for the transfer is a cash payment of £3000, one-third of which is to be applied in compensating the officers and servants of the Company, and the rest in expenses of the transfer, &c. Every £100 of preference stock carries an annuity of 4½ per cent., redeemable within a year at 30 years' purchase. Every original 10 per cent. share carries an annuity of £1; every 7½ cent. share, one of 15s.; and every 7 per cent. share, one of 14s. The Company retain their reserve fund of £1246 14s. 9d.; and also their undivided profits accruing up to June 30, 1891. Not more than £2000 is to be expended on capital account, without the written sanction of the Mayor, between the passing of the Act and the transfer. The Company's officers are not to be dismissed under a fixed period of grace. The Tunbridge Wells Improvement Act contains clauses requiring water-rates to be paid in advance half yearly, and for the creation of a water-works renewal fund. Provision is also made for selling water by meter.

**The Issue of Small Amounts of South Metropolitan Gas Stock.**—The Secretary of the South Metropolitan Gas Company (Mr. Frank Bush) writes that the experiment of offering small amounts of "C" stock to the Company's consumers, at the rate of £242 per £100 of stock, has proved a success. All the stock has been readily taken up; and numbers of applications had to be declined. The Directors have accordingly decided in future, when offering stock, to take steps to reserve a certain portion for their consumers, of which due notice will be given.

**The Works of the Consolidated Gas Company of New York.**—During the meeting of the Iron and Steel Institute in New York, the works of the Consolidated Gas Company were visited by the members. These works are the largest of the kind in the United States, and have a capacity for turning out daily 7,000,000 cubic feet of water gas made on the Tessié du Motay principle. This gas (which is, of course, non-luminous) is afterwards passed through carburetters and enriched. The air is delivered under pressure by blowing engines to 14 generators, each capable of making 600,000 cubic feet per day. The water gas decomposed in these holders is passed on to the carburetters, whence it flows through a series of heated retorts, when the unstable combination becomes a permanent one. Naphtha is largely used as the enriching material; but an important part of the plant is that in which petroleum is distilled into oil gas, and is used as a carburetting material, with results as good as when naphtha is employed. The present daily consumption of the gas supplied by these works is 4,000,000 cubic feet; and the storeage capacity is 4,600,000 cubic feet.

**The Great American Gas Undertaking.**—The Directors of the United Gas Improvement Company of Philadelphia recently informed the shareholders, by circular, that the Company had acquired the more important properties upon which options had been secured for the proposed American Gas Investment Company—the great undertaking formed some time ago to acquire the above-mentioned concern and a number of other gas enterprises in the United States. The sum necessary for the purpose was $50,000,000, of which $25,000,000 were allotted in America, and it was expected that a like amount would be taken up in England. Owing, however, to the American promoters declining to concede certain privileges asked for by the capitalists on this side, the negotiations fell through, and the formation of the new Company was not proceeded with. However, as already stated, the Gas Improvement Company will take up the properties and work them. Their present capital is $50,000,000; and this is to be doubled. One fourth will be required for the acquisition of the above-mentioned properties; and the remainder has been offered to the shareholders at par, payable in thirteen monthly instalments commencing on the 1st prox.

## NOTES.

### Another New Petroleum Engine.

The expiry of the "Otto" patent has let in a number of gas-engines which have been awaiting a free market. Among these are many petroleum engines which may be described, says *Engineering*, as gas-engines which are independent of gas-works because they make their own from the petroleum oils of commerce, which may be bought in the most remote spots reached by international trade. The Plymouth trials of petroleum engines showed that they work with one-fourth the weight of fuel of the best steam-engines of the same size, and already hold their own in this respect with the largest marine engines of recent construction. Among the newest petroleum engines which are offered in competition with coal-gas engines is that turned out by Messrs. Altmann and Küppermann, of Berlin. This is a vertical, single-acting engine, with a cylinder water jacketed in the usual way. The valves are all of the mushroom type, and are worked by cams. Ordinary mineral lamp-oil is the fuel, and is pumped by the movement of the engine into a small copper retort (kept red hot by means of a lamp), where it is converted into vapour. The ignition of the charge is effected in the usual way by means of an incandescent tube, heated in the first instance by the same lamp as the retort. This lamp has no chimney, and burns the oil with a blue flame like an atmospheric gas-burner. The whole construction of the engine is very simple; and it is reported to develop 1-horse power for a consumption of from one-half to three-fourths of a litre of oil, according to size.

### Pitch Cements.

In a recent issue of the *India-Rubber World* is given a description of many uses to which india-rubber and gutta-percha are put in conjunction with coal tar and pitch. Thus, for lining damp walls, or holding on to any constantly damp surface, there is no preparation equal to Jeffry's marine glue, the formula for which has been published and republished all over the world, but is still unrivalled. It consists of india-rubber, 1 part; asphaltum, 2 parts; coal tar, 12 parts. After having been massed, the rubber is dissolved in the undistilled coal tar, and the asphaltum is then added. This preparation lasts well for patching under water. Another well-known composition—Davy's Universal Cement—is made by melting in an iron vessel 4 parts of common coal-tar pitch with 4 parts of gutta-percha, and mixing well. It must be kept fluid, under water, or in a dry hard state. A cement for leather is obtained by mixing together gutta-percha, 100 parts; black pitch or asphaltum, 100 parts; oil of turpentine, 15 parts. This preparation must be used hot. A very adhesive cement, specially adapted for leather driving belts, is made from ten parts of bisulphide of carbon and one part of oil of turpentine, and dissolving therein sufficient gutta-percha to form a paste. Any oil or grease that may be on the surface of the leather to be joined must be removed by a piece of rag and a hot iron. The surfaces are then roughened, and the cement laid on thinly; the joint being subjected to a slight pressure until set.

### The Future of Russian Oil.

A paper on the employment of heavy naphtha oils for lighting purposes was recently read by M. Lissenko before the Imperial Russian Technical Association. This communication is of interest as illustrating the effect of utilization of a bye-product on its commercial value. It was ascertained twelve years ago that Caucasian petroleum differs from the American product in the smaller proportion of common lighting oil, or kerosene, which is obtainable from it. Pennsylvanian petroleum yields nearly twice as much kerosene as the Baku oils. The main object of the refiners of the latter oils has been to make as much as possible of a grade of oil that should be capable of supplanting American oil in the European markets. Consequently, they have made a great deal of refuse, well known under its local name of "astatki," which was at one time almost worthless. So cheap was this refuse, that its general use for carburetting water gas in all Europe has been confidently recommended. Now, however, steam navigation on the Volga and the Caspian, and on the Caucasian and Central Asian railways, has created such a demand for astatki that, as M. Lissenko remarks, the trade in it is so important that it can no longer be regarded as a mere bye-product. Up to 1878, astatki could be had in any quantity for ¼ copeck per pud; but it has been growing more valuable ever since, and is now worth at least 4 copecks per pud on the spot. The employment of astatki has taken too deep a root to be ever given up; so the question is whether the present method of distilling crude petroleum for kerosene and refuse only is the most economical that could be devised. M. Lissenko recommends that the astatki should be again rectified for the extraction of heavy lighting oil, which would have great advantages in use on the score of safety. At any rate, if this Russian writer is correct, astatki is not likely to be any cheaper than it is at present; and consequently the prospects of its utilization to any great extent for carburetting water gas become correspondingly dim.

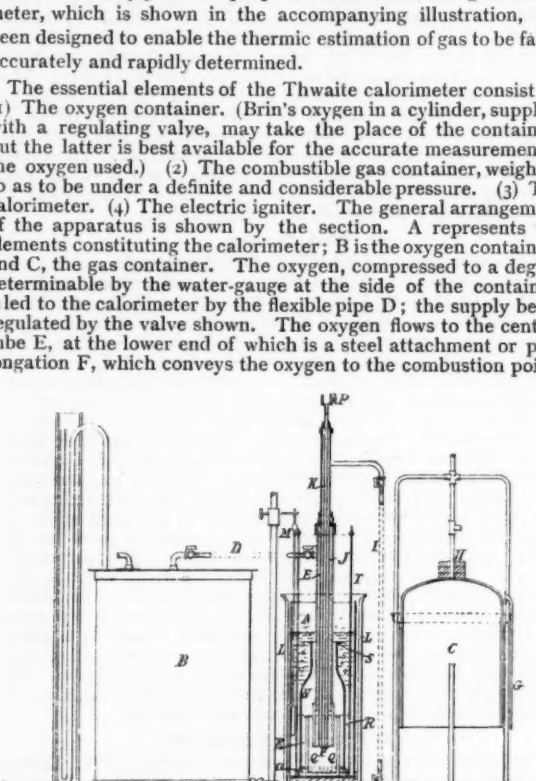
**Mr. John Runtz,** the representative of the New River Company on the Lea Conservancy Board, has been elected Chairman of the Board, in place of Mr. Alderman Meeson, deceased. The latter gentleman was one of the Directors of the West Ham Gas Company.

# TECHNICAL RECORD.

## THE THWAITE GAS CALORIMETER.

The thermic measurement of combustible gas is becoming a factor of increasing importance not only to the gas manufacturer, but also to the consumer; and calorimetric estimation will soon become as necessary and imperative as photometric estimation. For industrial applications in which gas is the fuel employed, the importance of a ready means of thermically estimating the gas is self-evident. Berthelot's calorimeter consists of what he terms a bomb, in which determined volumes of combustible gases are enclosed and exploded. But this instrument, though suitable for a physicist of skilled manipulative character, is useless for ordinary practical purposes. The Thwaite gas calorimeter, which is shown in the accompanying illustration, has been designed to enable the thermic estimation of gas to be fairly accurately and rapidly determined.

The essential elements of the Thwaite calorimeter consist of: (1) The oxygen container. (Brin's oxygen in a cylinder, supplied with a regulating valve, may take the place of the container; but the latter is best available for the accurate measurement of the oxygen used.) (2) The combustible gas container, weighted so as to be under a definite and considerable pressure. (3) The calorimeter. (4) The electric igniter. The general arrangement of the apparatus is shown by the section. A represents the elements constituting the calorimeter; B is the oxygen container; and C, the gas container. The oxygen, compressed to a degree determinable by the water-gauge at the side of the container, is led to the calorimeter by the flexible pipe D; the supply being regulated by the valve shown. The oxygen flows to the central tube E, at the lower end of which is a steel attachment or prolongation F, which conveys the oxygen to the combustion point.




The combustible gas in the container C is measured by a sliding bar G, which indicates by a pointer moving on a graduated scale how much gas is used. The exact compression required is obtained by the addition of weights H around the central guide-bar.

The combustible gas flows from the holder through the pipe and valve, and is connected by the flexible connection I to the calorimeter connecting-pipe attached to the central tube J, by which it is led to the zone of combustion. The ignition of the gas, which is effected by an electric igniter of the ordinary class K, takes place at the orifice of the gas-pipe at F, and combustion results in the combustion vessel; the products forcing their way through a certain and definite weight of water, placed in a vessel (which may be of glass) inside another vessel L. The temperature of the water before combustion is determined by the suspended thermometer M. The products of combustion are compelled to flow through the water because of the inverted bell-glass N, which is gradually lowered into the vessel $A^1$, so that the upper part of the interior of the vessel is filled with air. But it is usually the practice to ignite the combustible before the vessel N is lowered into the water. In that case the oxygen supplied under compression prevents the influx of air into this vessel, which is supported on a metal frame O, perforated with holes through which the products of combustion enter the water. The ignition of the charge is effected by pressing the knob P of the electric igniter, while the oxygen is turned on, and before and during the introduction of the gas. The combustion flows over the sides of the porcelain vessel Q, and through the space R and openings in the frame O, and bubbles through the water S. The water is well agitated by the lifting up and down of the frame T, carrying wire mesh discs similar to those used in Mr. W. Thomson's coal calorimeter, as improved by Mr. Donkin.

The method of using the Thwaite gas calorimeter is simply this: First ascertain the volume of gas in the container before putting on weights, and then compress to the necessary extent, or equal to the requirement for driving the products of combustion through the water. See that the oxygen is in sufficient supply and under sufficient pressure. Pour a given volume and known weight of water into the water vessel of the calorimeter, and determine the temperature of the water in degrees Fahrenheit. Turn on oxygen into the container, and at the same time press the knob of the electric igniter; then turn on gas until a sufficient volume has been used. Agitate the water with the agitators, and take its temperature. Ascertain the number of heat-units added by deducting the initial temperature from the final one, and multiply by the weight of water in terms of pounds avoirdupois. Divide this by the volume of gas employed in terms of cubic feet of gas used; and the result will be the value of one cubic foot of the gas in British thermal units.

For more refined accuracy, the weight in pounds avoirdupois of the parts of the calorimeter submerged in water should be ascertained; and this multiplied by the final temperature, less the initial temperature of the water, and the result multiplied by the specific heat of the different materials, and added to the calorimetric value already obtained, will give a result very near extreme accuracy.

## THE EFFICIENCY OF GAS-ENGINES.

In the JOURNAL for April 29 last, we noticed briefly a paper on the above subject read by Mr. T. L. MILLER, Assoc. M. Inst. C.E., M. Inst. M.E., before the Liverpool Engineering Society. The author dealt at great length with the question of the efficiency of various types of gas-engines; the result being an interesting communication, the text of which we commence to give to-day practically in its entirety.

In making a comparison of the efficiency of gas-engines of different makes, the course usually adopted is to compare the number of cubic feet of gas consumed per indicated or per brake horse power, without any reference to the heating power of the gas used. While this may be very convenient for commercial purposes, it is anything but an accurate method; and, in many cases, where the comparison is made between the consumption of gas per horse power obtained from trials in different localities, the results are of little worth, owing to the variation in the thermal value of the gases used. As an example of this, the following figures, which give the calorific value, in British thermal units, per cubic foot of different gases, may be of interest: Glasgow gas, 813; Liverpool gas, 770; Kilmarnock gas, 680; Manchester gas, 654; Birmingham gas, 639; London gas, 624; Hoboken (U.S.A.) gas, 617; Berlin gas, 549. From these figures it will be at once seen how unfair it would be to compare the results obtained from trials in Berlin, in terms of cubic feet of gas per horse power per hour, with those obtained from trials conducted at any of the other places mentioned. The course adopted in this paper will therefore be to compare the actual amount of heat supplied to the engine per indicated and per brake horse power per hour; and, for this purpose, the published results of trials conducted by independent authorities will, as far as possible, be used.

As the term "efficiency" will be used in three distinct senses, it will be as well, at the outset, if I clearly define what I mean by the word. First, we shall have occasion to use the term "absolute efficiency," or the ratio of the indicated horse power developed by the engine to the total amount of heat generated by the gas in the cylinder. This is most generally written $E = I.H.P. \div H.$ Next, we have what is termed the "theoretical efficiency," in which an indicator diagram is calculated on the assumption that all the heat is added at the point where it will be used to most advantage in the particular type of engine under consideration; that expansion takes place without loss of heat (the temperature only falling by reason of the work performed); and that the mixture is then discharged as rapidly and effectively as possible. The horse power obtained from such a diagram is then compared with the total amount of heat supplied to the engine; the result being termed the theoretical efficiency. This we denote by the expression $E_t = T.H.P. \div H.$ The last sense in which the term will here be used is that of "mechanical efficiency," or the ratio of the brake horse power to the indicated horse power developed. This is written $E_m = B.H.P. \div I.H.P.$

Having thus explained the various senses in which the term "efficiency" will be used, we will proceed to discuss the method of working of the three types into which gas-engines fall, under Mr. Dugald Clerk's system of classification. These are briefly: (1) Those in which the mixture is ignited at constant volume, but without previous compression; (2) those in which the mixture is ignited at constant pressure, with previous compression; (3) those in which the mixture is ignited at constant volume, with previous compression. In the first case, the charge of gas and air is taken in at atmospheric pressure and temperature; the supply is cut off, and heat is added at constant volume, raising the pressure to a maximum; the gases are allowed to expand, without loss of heat, until the pressure has again fallen; heat is then abstracted at constant volume until the pressure falls to that of the atmosphere—the remainder of the heat being abstracted at constant pressure as the gases are being discharged from the cylinder. Assuming that a cubic foot of air is taken into the cylinder, that heat is then added at constant

volume, raising the temperature to 2799° Fahr. (1537° C.), and that expansion takes place, without loss of heat, until the volume is doubled, the theoretical efficiency of the engine is $E_t = 0{\cdot}21$. In the second type referred to, the charge of gas and air at atmospheric pressure is taken into a pump, and compressed without loss of heat into a receiver; and from the receiver the charge enters the motor cylinder at the receiver pressure. Heat is added at constant pressure; the temperature of the charge being raised, and the volume increased. After a portion of the stroke is completed, the supply of heat is cut off, and the charge expanded, without loss of heat, until the pressure again falls. Heat is then abstracted at constant volume until the pressure reaches that of the atmosphere, when, as in the previous case, the heat is abstracted at constant pressure as the gases are being discharged from the cylinder. Assuming, as in the previous case, that the volume of the pump is 1 cubic foot, that the receiver pressure is 76·6 lbs. per square inch, that the heat added raises the temperature of the charge to 2799° Fahr., and that the final volume of gas is 2 cubic feet, the theoretical efficiency $E_t$ becomes 0·36. In the third type of this classification, the charge of gas and air is taken into the pump at atmospheric pressure; it is then compressed, without loss of heat, until the pressure rises a little; heat is then added at constant volume, considerably raising the pressure; after which the gases expand, without loss of heat, until the final pressure is reached. If the volume be then greater than that of the gases originally taken into the pump, the heat remaining in the charge is first abstracted at constant volume until the pressure falls to that of the atmosphere, and then at constant pressure as the gases are being discharged from the cylinder. If, on the other hand, the final volume of the gases is equal to the volume taken into the pump, the heat remaining in the charge at the completion of the expansion is discharged at constant volume. In the latter case, we have a number of different values for the theoretical efficiency of the engine, depending on the extent to which expansion is carried. If, for example, we assume that 1 cubic foot of air is taken into the pump at atmospheric pressure, and compressed to 60 lbs. per square inch, the heat being then added at constant pressure, raising the temperature to 2799° Fahr., the final volume being 1 cubic foot, the theoretical efficiency $E_t$ would be 0·37. It may be noted, with reference to this type of engine, that so long as the above cycle of operations is performed, and the volume of the gases, after expansion, equals the volume taken into the pump, the theoretical efficiency of the engine is determined by the degree of compression adopted, and is independent of the maximum temperature attained after heat is added.

The foregoing examples of the different classes of engines are taken, not because they include all the types that have been proposed and adopted, but because they represent the most successful types of engines of the system of classification adopted. Thus Lenoir, Hugon, and Bischoff engines are types of Class I.; the Brayton gas-engine, of Class II.; the Otto, Clerk, Beck, Griffin, "Simplex," "Forward," Fawcett, and "Ajax" engines, of the first division of Class III.; and the Atkinson engine, of the second division of Class III. It will be noted, on examining the conditions of working of the various types of engines referred to, that, in the case of Classes I. and II., the expansion of the gases, after heat is added, is supposed to continue until the final volume is double that of the gases originally taken into the cylinder; while in the special type of Class III. mentioned, the expansion is only continued until the final volume of the gases is equal to that originally admitted. If we now take an engine working according to the cycle described in Class III., the temperature of the charge being raised to 2799° Fahr. by the heat added at constant volume, and expansion being continued until the initial volume of the charge is doubled, the theoretical efficiency, assuming the charge to be compressed to 60 lbs. per square inch, is $E = 0{\cdot}56$. The values of the theoretical efficiency of the engines using the cycles of operations above described are as follows: Class I., $E_t = 0{\cdot}21$; Class II., $E_t = 0{\cdot}36$; Class III., $E = 0{\cdot}37$; Class III. (expanding to double original volume), $E_t = 0{\cdot}56$.

Of the above types of engines, those belonging to Classes I. and II. have now practically ceased to exist—those of the former class on account of their low efficiency, due to the absence of compression, and those of the latter class on account of certain difficulties of construction which have hitherto prevented their extended use. In spite, however, of the difficulties attending the working of the engines belonging to Class II., the advantages to be derived from their adoption are so great that it is quite possible it may become the engine of the future; as, with the application of a non-conducting lining to the cylinder, and the use of the regenerator, there is no reason why the theoretical efficiency should not be raised to 0·60 or 0·70. Mr. Hargreaves has done much good work in experimenting with different materials for use as non-conducting linings for cylinders and for regenerators, and has now obtained a material which is giving very good results in every-day work.

In the preceding paragraph, I stated that the low efficiency of the engines belonging to Class I. was due to the absence of compression. As the theoretical efficiencies vary in the ratio of 1 : 1·7 : 2·6, and as the absolute efficiencies will be found to vary to an equal extent, it may be asked how such compression of the charge, prior to the addition of heat can so greatly affect the conditions under which the gas does its work. To answer this question in anything like a satisfactory manner, it will be necessary to consider the causes of loss in a gas-engine. They may be summed up as follows: (1) Loss of heat to jacket water; (2) loss of heat through gases being discharged at high temperature.

We will proceed to take these sources of loss, and consider them in the order given. First, then, the loss of heat to the jacket water depends upon (*a*) the difference of temperature between the gases in the cylinder and the water in the jacket; (*b*) the extent of surface exposed to the heating gases and the cooling water; (*c*) the time the gases are allowed to be in contact with the walls of the cylinder; and (*d*) the thickness of the metal forming the body of the cylinder through which the heat must pass. As to the first of these sources of loss—the difference of temperature between the gases in the cylinder and the water in the jackets—the former factor (the temperature of the gases) depends on the degree of expansion, which in turn depends on the initial pressure in the cylinder of the engine. Thus, assuming 1 cubic foot of air to be taken into the cylinder and expanded to 2 cubic feet, we should get a ratio of expansion of 2 : 1 in engines of Class I.; of nearly 2 : 1 in engines of Class II.; and of 6·26 : 1 in engines of Class III. Now, as the degree of expansion is so very much greater, and the mean temperature correspondingly lower in engines of the third class than in those of the other two, the loss of heat to the jacket would, other things being equal, be correspondingly less; but it will be noted that the increased expansion, which causes the diminished loss, is due to the high initial pressure, which in urn is obtained by compressing the gaseous mixture prior to the addition of heat.

The difference of temperature between the gases and the jacket water, and consequently the heat carried away by the jacket water, may also be diminished by increasing the temperature of the water. In order to determine the gain due to this, Dr. Witz has made some experiments with a 2-horse power Benz gas-engine having a cylinder 5½ inches in diameter, with 11-inch stroke, in which he found that the gas consumption was from 4 to 10 per cent. less with the temperature of the jacket water at 158° Fahr. than at 64·4° Fahr. In a further experiment with a "Simplex" engine of 8-horse power nominal, the engine developed, with the jacket of water at 143·6° Fahr., and the speed 154·3 revolutions per minute, 6·7-horse power at the brake; the consumption being 21·96 cubic feet of gas per brake horse power per hour. With the temperature of the jacket water raised to 165·2° Fahr., and a speed of 161·2 revolutions per minute, the horse power developed at the brake was 8·67, with a consumption of 20·65 cubic feet of gas per brake horse power per hour. This shows a saving of 7 per cent. due to the diminished loss of heat through the cylinder walls. Mr. Dugald Clerk has also found a difference of as much as 10 per cent. in the consumption of gas in an "Otto" engine, with jacket water at 62° Fahr. and at 204° Fahr. It must not, however, be supposed that increase of temperature of the jacket water will always conduce to economy, as, if the cylinder of the engine is kept hot by raising the temperature of the jacket water, in addition to reducing the loss of heat through the cylinder walls, it has the further effect of increasing the temperature of the incoming charge, and so reducing the efficiency of the engine. The point at which the gain due to the reduction in the amount of heat carried away by the cooling water balances the loss of efficiency due to the heating of the charge, is one which varies in different engines, and can only be determined by experiment.

The second condition upon which the loss of heat to the jacket water depends is that of the extent of surface exposed to the action of the heated gases and the cooling water; the loss increasing as the surfaces are extended, and diminishing as the surfaces are contracted. It follows, then, that anything that will reduce the surface of the cylinder exposed to the action of the cooling water will diminish the loss of heat in this direction.

If we take theoretical indicator diagrams for the engines belonging to the three classes in which we have placed them, we shall find that the mean pressures work out as follows: Class I., 39·8 lbs. per square inch; Class II., 47·1 lbs. per square inch; Class III. (expanding to double the original volume), 58·17 lbs. per square inch. To obtain the same amount of duty from the engines working according to the cycles of operation above referred to, it would be necessary to make the areas of the cylinders in the inverse ratio of the mean pressures. Taking Class I. as unity, the areas would be as 1 : 0·84 : 0·68, and the corresponding surfaces as 1 : 0·91 : 0·82; showing a distinct gain due to compression in the case of engines of Classes II. and III.

The third condition that I mentioned in connection with the loss of heat to the jacket water was that of the duration of the contact of the gases with the walls of the cylinder. In connection with this subject, M. Witz made a series of experiments with a vertical cast-iron cylinder, about 7⅞ inches diameter, having a piston with a stroke of 12·72 inches. The explosive mixture was introduced under the piston, its volume noted, and the charge then ignited by an electric spark. The velocity of expansion of the heated gases was controlled by means of a counter-weight and break, allowing the experimenter to vary the rate of expansion from 0·82 of a foot per second to 32·8 feet per second. The conclusion arrived at by M. Witz from his experiments was that increase in the velocity of expansion caused the combustion to be more rapid; giving

rise to greater pressures, and diminishing the loss of heat through the cylinder walls.

The second cause of loss in the gas-engine. to which reference has been made, is that arising from the gases being discharged at high temperature. The only way in which this can be reduced is by increasing the range of expansion, as by so doing the final temperature of the gases is lowered. The final temperatures of the gases in the engines of the three classes referred to are as follows: Class I., 1992° Fahr.; Class II., 1992° Fahr.; Class III., 1562° Fahr.—figures which again show the superiority of the engines of Class III. over those of the other two classes.

From the foregoing considerations, we have seen that compression tends to reduce the losses in, and to increase the efficiency of, the gas-engine by allowing the expansion of the gases to be carried to a much greater degree than could be obtained without such compression, and by reducing the size of the cylinder required to develop a given amount of work; thus restricting the surface in contact with the heated gases, and thereby diminishing the loss by conduction to the jacket water. Compression is also of advantage in the gas-engine in allowing a more dilute mixture to be used when the charge is compressed before ignition than could be used if such compression were not adopted. The probable reason for this is that, in the dilute mixtures, the molecules of the gas are too far apart to allow of the inflammation of the charge to be communicated from the one molecule to the other. Compression, by making the charge occupy less space, causes the molecules to approach much nearer to each other; and this helps the inflammation to be communicated throughout the charge.

Another question of great interest in the study of the gas-engine is the difference between the observed and calculated pressures produced by the explosion of inflammable gases with atmospheric air. In connection with this subject, a large number of experiments have been made, to only two series of which do I propose to refer. One of these was conducted by Mr. D. Clerk, and communicated by him in a paper read before the Institution of Civil Engineers. In these experiments, Mr. Clerk exploded mixtures of different strengths of various inflammable gases and air. In the case of Oldham coal gas and air, he found, with mixtures varying from 1-15th to 1-7th of gas, that the heat accounted for by the maximum pressure of explosion was from 44 to 58 per cent. of that calculated from the total heat of combustion of the gas; the remainder of the heat being given out as the pressure of the heated gases fell. Experiments have also been made on this subject by Mr. G. C. Douglas, who varied the strength of the mixtures to a greater degree than Mr. Clerk. The results obtained by Mr. Douglas confirm in every respect those obtained by Mr. Clerk; the diagrams from the weak mixtures being especially interesting, as they show a considerable interval before the maximum pressure is attained.

To account for this difference between the observed and calculated pressure produced by the explosion of gaseous mixtures, three theories have been advanced. The first of these, which is associated with the names of Hirn and Witz, assumes that, owing to the cooling effect of the cylinder walls, a point is reached, soon after explosion occurs, at which the heat is abstracted more rapidly than it is given out by the combustion of the gases; thus limiting the temperature, and causing it to fall. The second theory is that propounded by Bunsen, and supported by Clerk in his paper on the "Explosion of Gaseous Mixtures," in Vol. LXXXV. of the Proceedings of the Institution of Civil Engineers. This theory assumes that the evolution of heat is checked by the high temperature produced in the cylinder splitting up the gases forming the mixtures in such a manner that, upon the temperature being lowered, the constituents recombine. This action is termed dissociation. The third theory is that set forth by MM. Mallard and Le Chatelier, and supported by MM. Berthelot and Vieille. According to this theory, the gases are completely combined at the maximum temperature of the explosion; the non-attainment of the calculated temperatures and pressures being set down to increase in the specific heat at very high temperatures.

Of these three theories, that of Witz fails to account entirely for the observed suppression of heat, as, according to it, the maximum pressure attained on the explosion of a mixture of known composition would depend on the proportion existing between the surface of the vessel and the volume of the mixture. This, however, is not the case, as the maximum temperature is almost independent of the capacity of the vessel; the effect of surface being rather to give a more rapid fall during expansion. The second theory likewise fails satisfactorily to account for the whole of the observed diminution of pressure, as, if so, the difference between the observed and calculated pressures should be greater as the temperature increased. This, however, is found not to be the case, as in Clerk's experiment on "Explosion in a Closed Vessel," he found that, with a maximum temperature of explosion (900° C.), it was 55 per cent., while at 1700° C. it was 54 per cent. These figures point to the conclusion that some cause other than dissociation must be looked for in order satisfactorily to account for this phenomenon.

For the same reason that has been stated in the case of dissociation, the theory that increase in the specific heat of the gases is responsible for this suppression of heat does not altogether account for the observed differences. That the specific heat does increase with rise of temperature is a fact that has already been proved in the case of carbonic acid, by the experiments of MM. Mallard and Le Chatelier; and it is therefore only natural to suppose that a like increase should occur in the case of the mixture used in the cylinders of gas-engines. Possibly the true reason for this suppression of heat is to be found in a combination of the theory of the increase in the specific heat of the gases with the fact observed by many experimenters of the dependence of the rate of combustion on the amount of diluent present in the charge.

*(To be continued.)*

## REGISTER OF PATENTS.

**Regulating the Speed of Gas Motor Engines.**—Abel, C. D.; communicated from the Gas Motoren Fabrik Deutz, of Deutz, Germany. No. 20,892; Dec. 30, 1889. [8d.]

This invention relates to appliances for regulating the speed of gas-engines by entirely cutting off the supply of combustible when the engine runs above the normal speed. In apparatus frequently used for this purpose in engines of the "Otto" type, this is effected by mounting upon a countershaft a sliding sleeve having a cam which, in the normal position of the sleeve, acts upon the gas-valve lever so as to open the valve and admit gas to the cylinder; but which is moved by the governor when the engine runs too fast, so that the cam misses the lever, and causes the gas-valve to remain closed. With this apparatus, however, it sometimes happens that the sleeve is brought into such an intermediate position by the governor that the roller of the gas-valve lever is just caught by the extreme edge of the cam, which consequently opens the valve; but the roller, in slipping off the edge again before the cam has completed its action, causes the valve to close prematurely, resulting in an imperfect cylinder charge and a consequent misfire.

The present invention has for its object to remedy this defect by preventing the possibility of the sleeve and cam assuming any such intermediate position, and by rendering the governor more sensitive in reducing the resistance it has to overcome. For this purpose the governor lever is not connected directly to the sliding sleeve; this being acted upon at every revolution of the countershaft by a cam on the latter, which, during the expelling stroke of the engine piston, depresses a lever (which may be the escape-valve lever), and causes it to move the cam sleeve through the medium of an elbow lever into the extreme position in which its cam escapes the gas-valve lever. This movement is effected against the action of a spring, which consequently moves the sleeve back to its other extreme position as soon as it is released by the escape-valve lever; this being, in its turn, released by the before-mentioned cam on the countershaft as soon as the expelling stroke is completed, so that the sleeve cam is then brought into correct position for acting on the gas-valve lever again at the next admission stroke. Thus the cam can only be brought into its two extreme positions.

The governor acts upon a lever which is connected by a link to a rod pivoted at one end to the engine frame, and having its free end moved into different positions by the governor according to the speed of the engine; this movement of the rod being the only work the governor has to do, its action is rendered very sensitive. When the engine is running too fast, the governor brings the rod into a position in which its end faces a notch on the escape-valve lever, so that, when this has been actuated by its cam (as described) so as to bring the sleeve cam into the position in which it misses the gas-valve lever, it is prevented from returning into its original position by the rod which catches into the notch. Thus it will be seen that the sleeve-cam will be held in the extreme position in which it misses the gas-valve lever until, by the reduction of speed to the normal, the governor is made to move the end of the rod out of the path of the escape-valve lever, whereupon it can return to its original position, and allow the sleeve cam also to move back into the position in which it acts on the gas-valve lever.

**Receiving Coin or an Equivalent, and Supplying Gas in Exchange.**—Middlebrook, C., of Bromley-by-Bow, E. No. 4737; March 26, 1890. [8d.]

This invention consists in the combination with a gas-meter of a lever, so arranged in relation to a coin shoot or passage and to a device operated by the meter when the latter is delivering gas, that the lever, when not depressed by a coin, forms a stop, and prevents the working of the meter. When, however, a coin is introduced so as to depress one end of the lever, the device is no longer obstructed; and the meter, being thus released, goes on delivering gas until the quantity of gas to be supplied in exchange for the coin has been delivered, Whereupon the coin (or the last one, if there has been several) will be caused to pass into a receptacle; and the lever will assume a position in which it will again lock the meter until another coin is inserted into the machine.

In the example shown, the meter is a dry one, provided with measuring bellows that oscillate two vertical spindles A $A^1$, upon which are fixed lever arms C $C^1$ respectively, by which motion is transmitted from the spindles to the worm-wheel D on the shaft of the counting mechanism E. F is the inlet for gas; and G, the outlet. The coin-receiving mechanism comprises an inclined coin shoot H, below which is a lever I, one end of which is arranged below the lower open end of the shoot, and the other end (which is weighted) is recessed at J to form a stop for an arm K when the lever I is in the position shown in fig. 1. The arm K is fixed to the spindle A, and is oscillated thereby when the meter is in action; but when its motion is arrested, it stops the working of the meter. L is a starting lever, so arranged that its lower end, which works through an opening in the roof of the shoot, will be caused to exert pressure through a coin B to depress the lever I, and disengage it from the arm K, should this be pressed so tightly against the lever by the gas acting upon the internal mechanism of the meter, when the meter is locked, as not to be released by the weight of the coin alone. As will be seen, this starting lever L and the roof of the shoot are so relatively arranged that the starting lever can only operate the coin lever I when a coin is located between them. M is a shoot through which a coin passes into a suitable receptacle, after it has

*Fig. 1.*

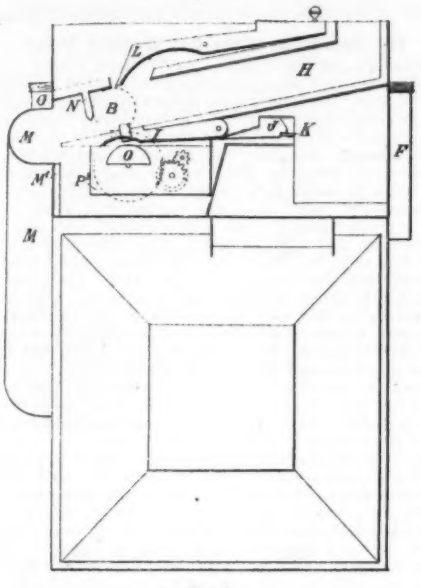


*Fig. 3*

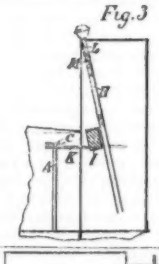
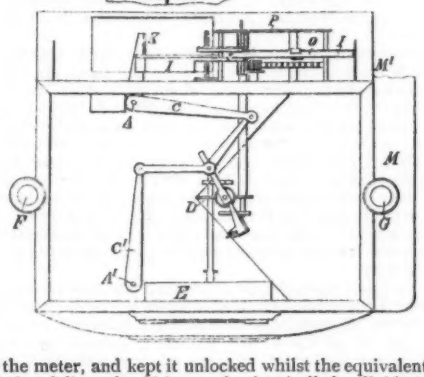


*Fig. 2.*



unlocked the meter, and kept it unlocked whilst the equivalent quantity of gas is being delivered. N is a projection (called a divider) arranged near the inner end of the shoot H. O is a cam, carried by a toothed wheel, and capable of being rotated by a worm-wheel as shown. P is a fixed plate for supporting the outer ends of the shafts carrying the toothed wheels shown; and $P_1$ is a similar plate to carry the inner ends of these shafts. $M^1$ (fig. 1) is an abutment or coin-stop, in front of which the lower end of the lever I moves when being depressed, and against which the coin rests, so as to maintain the lever in its depressed position, until it is raised by the cam O.

The operation of the apparatus is as follows: A coin B (say a penny) dropped into the shoot H through the slot, will roll on to the lower end of the coin lever I. The weight of the coin, aided by pressure exerted through the coin by the starting lever L, will depress the lower end of the lever on to the top of the cam O, thereby raising the other end of the lever sufficiently to release the arm K and unlock the meter. On the further falling of the cam lever, as the cam rotates from under it, the coin upon it will fall with it, but does not pass out of contact with the divider N until the extreme lower end of the lever is at such a distance below the top edge of the abutment $M^1$ that it will prevent the coin, when it rolls under the divider, from passing into the shoot M. The meter will then supply gas until the lower end of the lever I is partly raised, by the cam O assuming its uppermost position, when the coin will be raised sufficiently by the lever to clear the abutment and roll into the shoot.

One coin only at a time can pass into the shoot; and should there be more than one in the money-slot, the first coin will pass under the divider, and the second coin will, on the partial rising of the lever I, be separated from the first by the divider; the first coin being on the side of the divider nearest the shoot, while the next coin will be on the opposite side. The lever is so pivoted that, when no coin rests upon its lower end, this end will rise, and the upper end will fall sufficiently to come into the path of the arm K, and so stop the meter. But so long as there is a coin present to act upon the lower end of the lever, neither the weight of the upper end of the lever, or the cam, will cause the lever to assume a position in which it will stop the delivery of gas. The gearing for driving the cam is so proportioned that the cam makes one complete revolution whilst the quantity of gas to be delivered in exchange for a coin is passing through the meter.

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**Spring Governor or Regulator for Gas-Engines.**—Schiersand, P. M., of Kappel, Saxony. No. 11,834; July 29, 1890. [6d.]

This invention relates to an appliance for regulating the speed of gas, steam, and other engines and motors, by economizing the supply, and compensating the irregularities of the source of the motive power employed.

As applied to a motor having a vertical motion, the invention consists in attaching a pin or stud to any suitable part of the engine having a vertical traverse—such, for instance, as the piston crosshead—pivoted upon which is a metallic collar piece, having on its upper surface a pointer, and which is kept in a vertical position when at rest by means of a counterweight formed on the opposite or under side of the collar piece. A straight metallic spring is fixed centrally and horizontally upon the collar piece, in such a manner that each end is at right angles with the pointer; the apparatus, so far, resembling in appearance a scale beam with its index finger. The travel of the pin being vertical, the appendages must necessarily be identical therewith. Two castings (each provided with an internal or female-screw thread, and fitted with adjustable tap bolts) are fixed on the motor in such a manner that the bolts engage with the ends of the spring during its travel. In this way, at each upward movement of the stud, the pointer engages with a projection connected with or forming part of the throttle-valve or its equivalent of the motor, but otherwise is kept in a position of "shut off" by the tension of a spring attached to it.

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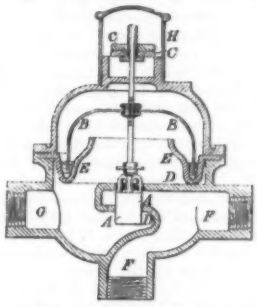
**Gas Governors and Regulators.**—Brown, J. K., of Glasgow. No. 10,884; July 12, 1890. [6d.]

This invention relates to apparatus so arranged that any undue sudden pressure of gas passing into the governor or regulator, acting upon the diaphragm or bell-shaped float, would raise the tube, so that the slots in it would be at a sufficient height above the bridge to cut off (or practically so) the gas from passing from the in-flow pipe into the inner chamber or body of the apparatus. As the pressure became reduced, the diaphragm or float would be acted upon inversely, and the valve consequently would drop into a normal position.



A is the valve, with its three radial slots; and B, the diaphragm or bell-shaped float. C are weights when required for adjusting the position of the valve to any desired pressure. D and $D^1$ are the upper and lower bridges, cast in one piece with the regulator, in which the valve works through the circular openings or holes. E is the mercurial cup, with an aperture formed at the apex for giving a passage to the gas to act upon the diaphragm or float. The outer rim of the cup is provided with a flange, which fits into a corresponding recess formed in the lower flange of the governor. F are the in-flow passages, intended for convenience in fixing the governor to the gas-meter or other place of supply. G is the out-flowing passage. H is a cap at the top of the governor arranged to be removed to allow of an inspection of the interior.

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**Dry Gas-Meters.**—Foxall, J., of Newport, Mon. No. 12,424; Aug. 8, 1890. [6d.]

The object of this invention, in reference to dry gas-meters, is to remedy certain "defects to which they are liable, both in respect of their endurance and of their working." It is well known (says the patentee) that the flexible perimeters, or creased annular portions of the measuring chambers forming the connections between the moveable metallic dics and the central partition of the gas-meter case, are liable to lose their shape and crumple up under the action of the meter, and eventually to crack at the accidental creases thereby formed—causing the accuracy of measurement to be interfered with, and an undue stress to be put upon the flexible portions of the measuring chambers. To prevent this occurring, it is proposed to insert stiffening rings in annular creases of the leather. In this way, while avoiding all obstruction to the free movement of the metal discs forming the moving sides of the chambers, the proper action of the flexible peripheries of the chambers is ensured by the rings maintaining or rendering permanent the circular shape of the flexible peripheries.

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**Manufacture of Lighting and Heating Gas.**—Key, J. T., of Shepherd's Bush, London. No. 12,860; Aug. 16, 1890. [8d.]

This invention relates to the manufacture of producer or lighting gas by feeding the fuel into the producer in a constant and regulated supply, and withdrawing it in a similar manner, with the simultaneous crushing or breaking of it up.

Fig. 1 is an elevation of the producer parallel to the axes of the supply and delivery drums; fig. 2, a vertical section at right angles; and fig. 3, a vertical section parallel to the same axes.

The producer is preferably cylindrical over the middle portion, and approximately conical towards the top and bottom, with a sheet-iron casing. D is the feed or supply drum, provided with longitudinal

*Fig. 1.*

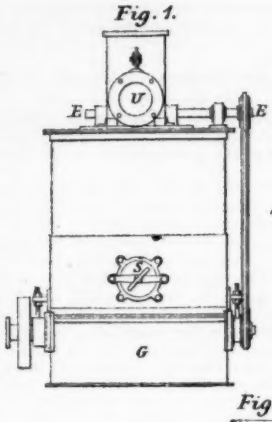



*Fig 2.*

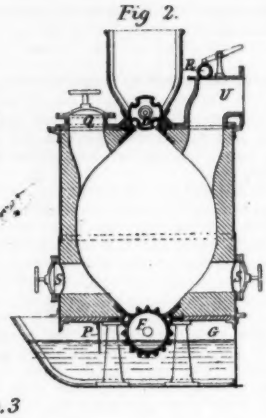
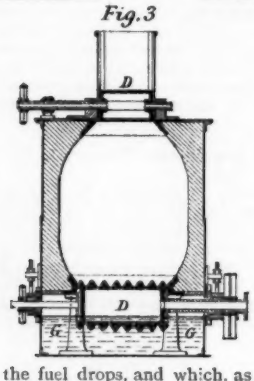



*Fig. 3*




recesses into which the fuel drops, and which, as the drum revolves, deliver the fuel in definite regulated quantity to the producer. The axles of the drum are hollow, so that a stream of water can be passed through to keep them cool or to heat the water. F is a hollow revolving delivery drum, for withdrawing the coke (and ashes or clinker) from the producer, and delivering it into the tank or cistern G. Between the two side plates of it and the drum F, the coke is crushed. There are holes through the shell of the drum F for admitting air (or steam) to the producer. P is a curtain opposite the sloping or inclined end of the cistern or tank, and which, dipping below the surface of the water, prevents any access of air to the interior of it. Q is a man-hole or hand-feed supply opening; and R is a ball safety-valve for the gases. S are manholes for entering the producer when repairs are required. U is the outlet-pipe for the gases.

The fuel is thrown into the hopper, which is preferably kept at least half full; and from thence it is supplied in regular definite quantities (as above described) by the supply drum D to the producer. The coke is similarly withdrawn from the producer, and at the same time broken up by the delivery drum F as it revolves, and is thereby thrown down into the water in the cistern G for the purpose of being quenched. It is afterwards conveniently withdrawn by hand up the inclined or sloping side. The air requisite for the production of the gas, or the steam for the production of the water gas, is admitted through the hollow axle into the interior of the drum F, and thence through holes into the producer.

The improvements in apparatus for the utilization of the gas comprise an atmospheric burner of special construction, and fire-brick blocks to be used in the internal flues of steam-boilers heated with producer gas.

## APPLICATIONS FOR LETTERS PATENT.

16,234.—LAYCOCK, J., "Improvements in coin-freed apparatus for allowing a certain quantity of gas to pass through a meter." Oct. 13.

16,245.—SAVILLE, G. E., "Improved apparatus for automatically governing or regulating the pressure of gas in gas-mains." Oct. 13.

16,248.—HAMER, F. G., "Improvements in or relating to gas-burners." Oct. 13.

16,301.—MACAULAY-CRUIKSHANK, G., "Improvements in gas-engines." A communication from C. White and A. R. Middleton, Oct. 14.

16,440.—SMITH, T. W., "Improvements in the manufacture of water gases and of illuminating gas." Oct. 16.

16,469.—LUCCHESINI, A., "Improvements in water-meters." Oct. 16.

16,517.—DAVIS, G. E. and A. R., "The purification of coal gas, and treatment of the bye-products." Oct. 17.

16,567.—HILL, A., "An improved atmospheric gas-burner." Oct. 18.

16,589.—POLLITT, J. and MANGNALL, J., "Improvements in the construction of gas-engines." Oct. 18.

**The Transfer of the Selby Gas-Works to the Local Board.**—A resolution was passed, at a special meeting of the Selby Local Board last Friday week, authorizing the Chairman (Mr. Mark Scott) to affix the seal to a provisional agreement between the Board and the Gas Company for the purchase of the gas-works for the sum of £20,000; that application be made to the Local Government Board for a Provisional Order, under the Gas and Water Facilities Act of 1879; and that the Local Government Board be also applied to to sanction the raising of a loan of £20,500, either on mortgage of the rates or by debenture, to enable the Board to construct and maintain gas-works and any other necessary works in connection therewith.

# CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

### The Decadence of the Gas Workers' Union.

SIR,—What has happened to the Gas Workers' Union? I ask this question because a year ago no man was to be allowed to work who did not join the Union. The Manchester stokers struck on this ground; and members who did not pay up were to be "removed" under the threat of a strike, which was carried out in our case. The leading spirits of the Union officially declared, "It is wholly and solely a fighting body;" and even after the strike had proved a failure, the Union would not allow its members to return to their employment unless all the new men—the "*free*" *men*—were discharged. Again, at Leeds in July, after an exhibition of gross violence which the leaders of the Union gloried in, and tried to justify, they demanded the dismissal of all the new men, to which the authorities disgracefully yielded. In September last the Manager of a provincial gas-works informed me that, under the threat of a strike, by the orders (or with the consent) of his directors, he had told his non-Union men to join the Union; and in the same month, in consequence of the difficulty of inducing the winter hands to pay up their subscriptions, which had fallen into arrear during the summer interval, the Union made those astounding "suggestions" to the Chartered Company which, had they been yielded to, would have made that Company—as, in fact, one of the delegates who spoke against non-Union men being employed asked the Directors "to declare the Company—a Trades Union office."

This move on the part of the Union was a proof of its weakness—showing that it could not collect the subscriptions; and the weakness of the position was emphasized when the Union Secretary, in reply to the question put to him at the conference on the 3rd inst. at Horseferry Road, "What is to be the result if we do not accept your suggestions?" said: "As far as I know, we shall go on as before." This might mean little or much; but the result has shown that the Union was not prepared to order a strike against the free men, though, to do the Secretary of the Union justice, he at that interview freely and frankly admitted the right of a non-Union man to earn his bread. This being conceded, the most remarkable change appears to have taken place; for, if my information is correct, free men are working without interference, and unionists are asking themselves what is the use of paying subscriptions if non-unionists have equal rights with them—thus greatly increasing the number of "refractory" members, and also, I imagine, the difficulties of the stewards. It is said that, at one large branch, the subscriptions have fallen from £2 to 2s. on a pay-night; and I was told this week that at another branch only 4d. was taken. Whether or not the collapse is to this extent, the Manager of the works (with perhaps a hundred men in the retort-houses) with which the last-named branch is connected told me that the unionists now make not the slightest objection to non-unionists; and, in fact, the question is never raised.

Under these circumstances, is it not a favourable opportunity, and would it not be wise on the part of directors and managers, to introduce arrangements for the benefit of their workmen, and for the purpose of attaching them to their employers, particularly by a system of pensions which the Dock directors have just adopted (see the *Daily Telegraph* for Oct. 24); and by the adoption of some system of profit-sharing for which all gas companies, and especially those under the sliding scale, have peculiar facilities? In fact, they are hardly complete without it; for their success and continued prosperity are so dependent on selling gas at the lowest practicable price, that it is almost a necessity to bind all concerned—consumers, shareholders, officers, and workmen—in the common interest of efficient and economical working to ensure the desired result.

Had I, a year ago, when the profit-sharing plan was introduced, been asked whether I expected to attain this object, my reply would have been doubtful—simply an expression of hope that it might come in time. But there can be no doubt that mutual good-will and confidence, coupled with the union of interests of employers and employed, is earnestly to be desired, and is worth any effort that gives promise of its attainment. Whether or not good progress in that direction has been made, your readers must judge for themselves; but I can say, as the result of the experience of the twelve months, that all our hopes and expectations have been exceeded, and that the profit-sharing scheme was the means in the first place of attaching to the Company the thousand men who had not, but who to a great extent doubtless soon would have joined the Union, and since then it has been the principal agent in producing the present satisfactory relations between the workmen and the Company.

I believe that other companies would ere now have adopted the system of profit-sharing, had they not been under the impression that the Union would put difficulties in the way. It is, however, most improbable that, after having once struck against profit-sharing and failed, and found public opinion so entirely against them, they would repeat the mistake. Here the offer was made to every, or *any* regular man in the Company's employ, on condition that he would sign an agreement for a certain term. Its adoption was not dependent on its acceptance by a majority, or by any number of the employees. If only one man had accepted, he would have had the same benefit as if all had accepted; while those who might not choose to accept could remain in the Company's employ on the old terms. But for this option given to the men individually, the profit-sharing scheme would have died in its birth. The strike—for a strike, unless the continuous demands of the Union were conceded, was inevitable—would have been fought on less advantageous grounds; and it is not likely that the men would have manifested that kindly feeling and confidence towards their employers that now happily exist, to the mutual advantage of themselves and the Company. I hope these relations may long continue; and in the desire that others may enjoy them, I send forth this letter.

GEORGE LIVESEY.

*South Metropolitan Gas Company,*
*Oct. 24, 1890.*

P.S.—Copies of the profit-sharing rules, and full information on the subject, will be gladly given on application to the Secretary, Mr. F. Bush, at these works.

### The Gas-Workers' Union and Its Executive.

SIR,—Referring to the letter under the above heading in the last number of the JOURNAL, allow me to say that I do not know what breed of dog your correspondent belongs to, but evidently he is trying his mouth at badger drawing. The reason that I have not answered before is a very plain one. I have been in Ireland on business, and did not see the JOURNAL. Your correspondent seems surprised that I did not answer, seeing that I like to see my name in print. Well, Sir, I do not care to see my name in print; but whenever I see lying statements in the press, it is my duty to contradict them—on which occasions I am not afraid to sign my name. Your correspondent, on the contrary, signs himself "In the Know." Very likely he has no name. If he has, why not have the courage to give it publicity? This wily dog is bent on information; and, in order to obtain it, he makes use of lying assertions. He says that for every day worked by some men, the Executive demanded from them in some cases half their earnings, in other cases 1s. 8d. per day. This man (save the mark!) if not a liar, is a complete stranger to the truth; and I will give him a chance. If he can bring to your office, face to face with me, one man who has been served so, I will give that man my week's wages. When that unfortunate affair took place, the Executive imposed a levy on the sliding scale—viz., men earning over 30s. a week, to pay 1s. a week levy; those earning from 25s. to 30s., to pay 6d. per week; and under 25s., 3d. per week. And, to their everlasting credit be it said, right nobly did they respond. With respect to his quotation, "Sure its myself," &c., I treat that with the contempt it deserves. In this, as in all other such cases, it is hard to cope with imposition. A few—very few indeed—cases occurred where the strikers who were working all the week presented themselves at the pay-table for strike pay. "In the Know" would like to see Ward, Thorne, and Co. at the scoop and rake again. Well, that would not trouble either party in the least. In England to-day there is not a better timekeeper than Thorne, as the books in the Old Kent Road will prove; and during the time the writer of this letter worked at East Greenwich, I only lost one day, for which I had my foreman's leave. That was on a Saturday evening when I accompanied Thorne to Deptford Broadway to protest against expressions used at the Wade's Arms, Poplar, "that all the stokers were coming out on principle, to aid the dockers in their struggle." No, Mr. "In the Know," we are not afraid to go back into the retort-house; and when our clients think fit to remove us, we will work as energetically for the Union as ever we did. For eleven weeks we paid the strikers 10s. per week, with an additional 5s. per man on Christmas Eve; and on another occasion an additional half-crown, on Jan. 18—to give the lie to that rag the *Evening News and Post*, which stated that we had no funds for four weeks. We paid them 8s. per week; and on the last two weeks we gave them 2s. per man. In relieving old men it has cost us since then upwards of £300.

Now, Sir, I think I have answered this user of Yankee slang; and if he is not satisfied, I will meet him and show him figures for what I state. As for receiving a knock-down blow from the Chartered Company, I deny that *in toto*. It is mischief-makers like your correspondent who caused that scare, as we never once thought of striking. We are on friendly terms with that Company; and we are sorry that meddlers in other people's affairs are causing them to go to such unnecessary expense.

W. H. WARD, Assistant-Secretary,
Gas Workers' Union.

144, *Barking Road, Oct.* 24, 1890.

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SIR,—I feel rather surprised at seeing such a letter as appears in the JOURNAL for the 21st inst. from your correspondent "In the Know." There is a line that says "'tis bad to know a little." If your correspondent had obtained a copy of the rules of the Gas Workers' Union, he could have seen for himself whether his charges were correct; and for a penny he could have obtained the half-yearly report for the period in which the South Metropolitan strike occurred.

As your correspondent is "in the know," cannot he enlighten those who want to know *re* the detailed list of the amount of strike pay that each man received? Why not ask the Gas Company for a similar return as to their expenses? As to the "poor dupes," I fail to see that they are "dupes," as the Union gained for them the eight-hour day in and around London and elsewhere; and as Mr. George Livesey stated at the time they had offered the men the eight-hour day some time previous, it was arranged all right, and Thorne and Co. received the thanks of those "dupes." But when the bonus scheme was introduced, those "dupes" who had received one benefit sought, as they thought, another which, as Mr. Thorne has stated, was not sanctioned by the Union. Other places that he has enumerated also acted in the same way as those "dupes." As I stated in the JOURNAL for Dec. 17 last, there is a class of workers called "blacklegs" who cannot afford the 2d. subscription, or cannot go elsewhere, but will do anything that they are asked for a small consideration such as the bonus, with twelve hours' work in preference to eight hours, which is long enough under existing conditions for retort-house men to labour. Mr. Livesey approved of eight-hour in place of twelve-hour shifts; but he soon altered it to suit his own convenience. This question of hours was the subject of a paper read at the meeting of The Gas Institute; and the eight hours were approved by many. As to men being "dupes" because they did not get all they wanted, is nothing new. If they get most of their demands, I have found that they fail in their contributions. So that there is a failing each way; and human nature is never satisfied. If the leaders do their level best, and the project win, "all right!" Should it fail, they are held up to ridicule by those who profess to be "in the know."

R. WESTLAKE.

23, *Eldon Road, Bristol, Oct.* 23, 1890.

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### Electric Lighting at Hastings.

SIR,—The letter from Mr. Lees on this subject, in the last issue of the JOURNAL, requires very little answer from me. In my letter I distinctly referred to *public* electric lighting by arc lamps; and I repeat there are only fifteen of these. As regards their lighting power, they were most carefully tested with a portable photometer by a skilled photometrist, and the *average* actual light given was, as I stated, under 300 candles; and this quite accords with my own experience of Brush lamps elsewhere. Our front-line is lit with "Whitehall" lamps of 100-candle power, and the fifteen arc electric lamps; and my comparison of their appearance from the sea was made between these. With a sea frontage of 2¾ miles, I repeat that at a short distance from shore it is impossible to pick out the electric lights from the gas-lights. The electric light has been removed from the Pier Pavilion. No one doubts it was a success as regards lighting—four powerful arc lights in place of about 80 small gas-jets; but what about the cost?

In conclusion, Sir, I am perfectly aware of what electricity can do, and has done. I do not look upon it as a rival, but as an alternative; and I hope we shall find sufficient intelligence here to maintain the popularity of gas.

CHAS. E. BOTLEY.

*Hastings and St. Leonards Gas Company,*
*Oct.* 23, 1890.

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### The Water Supply Inquiry by the Corporation of London.

SIR,—Now that the Committee of the Corporation of London on the question of water supply has completed its task and presented its report, it will be an opportune time to review the evidence given during the inquiry.

Commencing its labours on May 23, it held thirteen meetings—eleven in London, one in Manchester, and one in Glasgow. Sir W. Guyer Hunter, K.C.M.G., M.P., presided over the Committee on all occasions except one—viz., on June 13. At the opening meeting, the scope of the inquiry was explained by the President, who said:

"This Committee will invite, and cordially invite, one and all who may be able to give information on the subject to do so, provided the information which they are able to give be that which is known personally to themselves, and not from outside sources. We shall look to them—or rather we shall cordially invite them—to assist us; and I feel from what has already fallen from those around me, that they will give helpful and cordial assistance. With these few and brief words, I declare the inquiry open; and I shall be very glad to hear any witness who may come forward to give evidence here."

This was apparently an invitation to persons possessing information upon the subject to come forward and give it; but, from the Committee's subsequent procedure, it must have meant that they would invite those whom they selected to give evidence. This, in point of fact, was exactly the course they pursued; the witnesses, with very few exceptions, being members or officers of the various civic and local authorities. In commenting upon the evidence, some difficulty is experienced owing to the questions not being numbered; so that only a reference to the page of the printed report of the proceedings is possible. Throughout the whole inquiry the public were admitted; but on four of the five occasions upon which I was present I was the sole representative; and on the fifth occasion, one other besides myself formed the audience. The Water Companies were not in any way represented.

The evidence of Mr. Scott (the Chamberlain) was chiefly as to the accumulation of sinking funds. Mr. Goldney (the Remembrancer) spoke as to the origin of rating in the Metropolis. Mr. S. Wood (of Messrs. Alfred Lass and Co.), at the third and subsequent meetings, gave most detailed and valuable statistics as to the accounts of the Metropolitan Water Companies and the quantity of water supplied by them. The mass of tables handed in by this witness are of the utmost value, as would be expected from the fact that the annual "Analysis of the Accounts of the Metropolitan Water Companies" is compiled by his firm. Mr. Cooke related the history of his dispute with the New River Company, which terminated in the House of Lords adversely to him.

As to the quality of the water, the views of Mr. Jabez Hogg are given. He said (p. 77): "The whole of the water supply of the City of London is of a very indifferent quality, and some of it quite unfit for general use." This reference to the New River Company's supply was allowed to pass, and was never controverted. It may therefore be as well to look into the actual state of the water, as described in official reports. The report of the Chemists, Messrs. Crookes, Odling, and Tidy, for January, 1890, states that "the quality of the water has continued to be of the same high character." On p. 78 Mr. Hogg says: "During the last ten years the water has been much harder; the hardness has increased from about 8 to 16 degrees, whereas the water required for family use ought not to exceed 5 or 6 degrees of hardness." Reference to the evidence given before the Duke of Richmond's Commission in 1879 shows the hardness to be about 14 degrees (p. lxi.). For the first five months of 1890, it was, by the Official Examiner's report, under 15 degrees, and for the month of May last actually only 13 degrees. On p. 79, Mr. Hogg states that water above 5 or 6 degrees of hardness is injurious to human beings. Referring again to the evidence given before the Duke of Richmond's Commission (p. cxxvii.) I find it stated that "the hardness of the Thames water is quite unobjectionable, and in no way prejudicial to health." Again, Mr. Hogg's statement on p. 78, that the Companies have done nothing to improve their works, is a manifest misrepresentation, patent to anyone acquainted with the facts; and this is the more gross when it is seen by the Official Examiner's report for January, 1890, that the quantity of oxygen required to oxidize the organic matter had decreased enormously, as shown by the following table, which gives it in grains per gallon:

| | January, 1890. | | Average, Ten Years, 1868-77. |
|---|---|---|---|
| New River | 0·024 | .. | 0·053 |
| East London | 0·047 | .. | 0·079 |
| Chelsea | 0·053 | | |
| West Middlesex | 0·057 | | |
| Lambeth | 0·053 | .. | 0·089 |
| Grand Junction | 0·038 | | |
| Southwark and Vauxhall | 0·059 | | |

The quantity of 30 gallons per head of the population daily does not satisfy Mr. Hogg, though doubtless quite one-third of this is entirely wasted; and in well-managed towns the water used for domestic purposes does not amount to more than 16 gallons per head daily—a constant supply, day and night, being afforded. On p. 81, Mr. Hogg states that "upon a house rated at £40 a year in Manchester and

Birmingham, the rate [*i.e.*, the water charge] would be £1 per annum, as against £3 in London on the same rateable value." Well, this is a definite statement; but it is exceedingly disingenuous, to say the least of it. The charge in Birmingham for a £40 house (rateable) is £2 6s. per annum, while in London it varies from £3 6s. in the case of the Lambeth Company to £1 16s. in that of several of the other Companies; the average of the whole eight being about £2 2s. In Manchester a £40 house (see p. lxxxviii. of report of the evidence given on the eleventh day of the inquiry) is charged 3d. in the pound for a general public water-rate—*i.e.*, whether the occupiers use the city water or not—amounting to 10s. per annum; and 9d. in the pound for a domestic water-rate, amounting to £1 10s. per annum; making together a gross charge of £2 per annum. Again, after an absence of some days, Mr. Hogg came to the front with a statement (see p. 128) as to fish and eels in the water-pipes, which he said "constitute a breeding-ground for fish of considerable size; eels and smaller water animals of various kinds are known to breed in these dead ends." Now, the report of General Scott and Mr. Power on this question dated July 16, 1887, is before me, and directly controverts this, and shows such an assumption to be entirely without foundation.

Mr. G. Webster, an Australian Merchant, went before the Committee with a scheme for bringing in a completely new supply to London of *two gallons per head daily*. It is significant that he apparently cannot get beyond the "boundary of Hanwell."

Mr. A. E. Dobbs was strongly in evidence before the Committee, as might have been expected; but he did not add much to what was already known, except upon one point (p. 153), where he stated: "I believe the New River Company, if its construction of the law is right, could nearly stop the trade of London—they could raise the rates to such an enormous amount." The President remarked that this was a most important statement; and he thought they ought to have it in evidence. Mr. Dobbs thereupon said: "Very well; I do not want to shirk the responsibility." This is also definite, like Mr. Hogg's statement—and as inaccurate. Mr. Dobbs again attended before the Committee (see p. 190), and delivered a series of short lectures. He acknowledged that he had not on the previous occasion "sorted his facts"—a very mild way of explaining that he had made a statement which was not a fact. If he had wanted to state the "fact," it is a pity he did not say that the New River Company have power to charge not more than 7½d. to 6d. per 1000 gallons, according to quantity, with an additional 25 per cent. for high service, or at the rate of less than 1d. per ton. The charge in most towns is much higher. For instance, in Nottingham it is from 1s. down to 8d.; and in Manchester 2s. downwards, according to the quantity used. But it is difficulty to find—I speak from a knowledge of more than 200 scales of charges—many as low as 7½d. per 1000 gallons.

Colonel Gouraud gave evidence that he paid for his business place £700 rent and 16 guineas a year for water—or less than 2½ per cent.; whereas at his private house at Streatham he paid £200 rent and £12 a year for water. "There," he said, "I have any number of baths, tubs, stables, horses, and so on, and use a great deal of water." So apparently he had not much cause for complaint; in fact, he was rather a trying witness, and was very soon "not troubled any more."

Mr. Birch, a Civil Engineer—about the only independent engineering witness, excepting Sir R. Rawlinson—very properly drew the attention of the Committee to the fact that the zymotic death-rate of Glasgow, with the very pure Loch Katrine water, is much higher than that of London; and he stated respecting the Thames water: "We have no figures or facts to lead us to suppose that by going to any other source in the world we should get any better water, so far as health is concerned." He might have adduced as further evidence the death-rate of Manchester on Sept. 24 last—31·6—as against that of London, 16·2.

Sir R. Rawlinson gave evidence generally in favour of the Thames water; and he recommended that it should be collected before reaching the river and then softened.

The evidence taken in Manchester and Glasgow, though of interest, is hardly applicable to the case of London, as both of these cities are supplied by works totally different in every respect from those serving the Metropolis.

The foregoing is a summary of the evidence given before the Committee, with some comments thereon. A careful perusal of the evidence does not go to show that the inquiry was by any means exhaustive; and, much as it is to be desired that the whole district now served by the London Water Companies should be brought under one controlling body, there yet remains the difficulty of solving the great question as to how a Water Trust should be constituted which, while commanding public confidence by its representative character, should be moderate in point of numbers, and be satisfied to gradually improve the existing state of things by jealously guarding the Thames and other sources from contamination, by giving a constant supply over the whole area, with judicious regulations as to the quality of fittings and workmanship—thus saving much of the present waste, which amounts to upwards of 50 million gallons daily, costing, for pumping and filtration only, nearly £50,000 yearly—and not rushing into new schemes, regardless of the necessities of the case and of the cost to the public.

E. K. Burstal, M. Inst. C.E.

38, *Parliament Street, S.W., Oct.* 20, 1890.

### Gas Heated Baths.

Sir,—For the sake of the public safety, we are most anxious to make as widely known as possible the real conditions of safety in the use of geysers. We have tried to do so by circulars and advertisements; but the last terrible accident [*ante*, p. 863] has shown that our attempts have not as yet been entirely successful.

So far as we have been able to investigate, in every case of accident there was no vent-pipe; and our experiments have convinced us that, with a vent-pipe, there is no risk. What we wish to emphasize is that no verbal warnings, whether by cards or stamped into the geyser (as Mr. Chapple suggests), are sufficient without a pipe; for the evident reason that any careless or ignorant person may so easily neglect any such caution. The vent-pipe acts by itself, and quite independently of the care or attention of anyone.

Our difficulty is not as to geysers now selling, to which an enamelled label is fixed conspicuously, stating that the geyser must not be fixed without the pipe; but we ask your aid to enable us to reach owners of geysers which have been fixed years ago, before we were fully alive to the danger, and did not think a vent-pipe necessary.

Ewart and Son.

304, *Euston Road, N., Oct.* 24, 1890.

## MISCELLANEOUS NEWS.

### THE STRIKE OF GAS STOKERS IN MELBOURNE.

#### The Managers' Troubles—A "New Chum's" Story.

In the last two numbers of the Journal, we have given our readers a tolerably full account of the recent strike at the Melbourne Gas-Works; the story last week having been kindly furnished by a correspondent in the city. We have since received from another source a communication which confirms the accounts already published, and furnishes satisfactory assurances of the complete victory of the Company. A few particulars from this letter may not be without interest, especially to those of our readers who have had to cope with a strike of their stokers.

First, as to the cause of the strike. This, it will be remembered, was the reception by the Gas Company of coal unshipped by "free" labour; and the consequent intervention of the Trades Hall Council to prevent this material being employed in gas making, by calling out all the stokers and firemen at 24 hours' notice. But what would have been the result if the Company had declined to receive the coal? They would not only have broken a very favourable contract, but would have been "knuckling under" to their own servants. Besides, they very properly refused to be dictated to by any irresponsible body of outsiders. The Directors' decision was a bold step; and as nearly all the men in their employ were Unionists, the Managers at the Company's three stations found themselves one fine morning with empty works. The effect produced on the mind as they contemplated their position will not be easily effaced. The labour attending the engaging of new hands and teaching them how to do their work, providing them with the necessary food and shelter, and protecting them from the assaults of their enemies—who can adequately describe all this but one who has passed through the ordeal? Then there were the incidental troubles attending the disorganization of the regular working—such as furnaces being full of clinker, ascension-pipes stopped, mains fouled, purifiers and everything else neglected, new men discontented with their food and beds, and the hundred-and-one other annoyances attending the introduction into the works of a mixed lot of men, some of whom did not scruple to resort to dishonest tricks. It simply meant for the station managers, during the height of the crisis, being in harness continuously for 36 and even 48 hours at a stretch; and the labour involved must have been truly exhausting. It was an experience which it is to be hoped they will never have to pass through again. In the midst of all their troubles, however, they doubtless found some encouragement from the numerous offers they received of assistance from outside sources—"all sorts and conditions of men" coming forward as volunteers. At the West Melbourne works there were actually doctors, barristers, and other professional men working; and all the office staff—collectors, inspectors, ledger-keepers, &c.—worked like troopers. When the men struck, there were upwards of 500 retorts in use at these works; and within a week two-thirds of them were again under fire. Of course, there were the usual idle threats to blow up the works and all within them; but these were properly disregarded, and the Managers simply "pegged away" with the hands at their command—making the latter as comfortable as they could by organizing concerts, &c. At the time of our last advices the difficulty had been well overcome; the only trouble presenting itself being in the direction of the coal supply, as all the mines were closed.

In connection with the foregoing, it may not be uninteresting to reproduce, from the *Melbourne Evening Standard* of Aug. 28 last, the following account (written by one of them) of how the "New Chum Brigade," as the new hands were called, went about their work: I am without my shirt, writing between the shifts, grimy as a nigger minstrel; so I know I am a "blackleg." It was late afternoon when I went down the wharf, and cabby drove me right into the gas-works gates through the howling, boo-hooing mob who hung around the portals of the West Melbourne works. The retort courteous I know; but a gas-retort I had never been introduced to before. Still, our meeting was not frigid and distant, but warm and hearty. A smart, fat little man eyed me all over, and drafted me into a team of ten; giving us to understand that we were to work a shift of four hours. Pointing to a grimy hole, he said, mildly, "There's your dressing-room;" and we stripped. Off peeled the white shirts, disclosing some good physiques, but also bringing to view various pairs of long, lean arms. An old hand, spare and wiry, and black as Othello, gave us the working tools; and we were soon at it. Othello opened the retort doors, carefully firing the escaping gas, and we raked out the lambent coke, which fell in ruby heaps soon to be quenched by buckets of water. Then came a big scoop on the scene. "Fill it, lads," was the order; and we filled it. It was no mean weight, and four of us ran it into the glowing retort. "Not bad fun," remarked a nuggety-built man. "Fun, d'ye call it?" responded one of the lean kind. "I call it plagey hard work;" and he smudged his face with his black paw as he wiped the big drops of sweat from his brow. "They earn all they get, do the stokers," said a podgy, middle-aged man; "and I'd sooner take indexes than be at this game. Only for keeping a light in the town I'd never tackle this at my time of life." I strolled over to the mess-room after our shift was relieved. It was a big shed, where two masculine angels dispensed first-rate "tucker," tea, and coffee. Stoking is a great leveller; and we sat down cheek by jowl, and drank the warm aromatic coffee, and the hot soothing Congou. J. T. Wynn, C.E., boss of the works, flitted here and there, blackened a bit, but still the same dapper, smart little man, a trifle of anxiety in his eye, but plucky and confident on the whole as he scanned the soiled amateurs who constituted the

"off gang" feeding there. "Come and find a place to sleep," said my left-hand comrade. He led the way to the dormitory. There lay straw beds ranged closely on the floor of an upper store. They had mostly all been slept on—but by whom? My mate is the "office" man, and he suggested ideas about the likeness of the dormitory to a night shelter up-town; so we quietly sneaked off around the retort-house, and found an unoccupied bit of floor in an engine-room. With our forearms for pillows, we slept that night; and waking stiff and cold in the grey morning, we shuffled along to the canteen to thaw our muscles with some Souchong, which stood steaming and invitingly warm in big white jugs. Then again across the yard to join our team at the retorts. They looked weedy in that grey morning light. Outside, the big holders were slowly, but surely, rising. Their big forms silhouetted against the deep blue; and across the asphalted and curbed yards flitted the gangs of amateur stokers on and off their shifts of work. Here the chief meter inspector, Mr. Cox, with his men, stood in the glow of fires in the retort-house, in picturesque and unaccustomed semi-nudity. There passed the budding gas engineer, Mr. Boudrey, in blue serges and a flannel shirt. Across the yard, with a difficult movement, and leaning on a stick, went Mr. Monk, a volunteer boss for the engine-room; and Mr. Wynn—still dapper as ever in the early dawning—flitted in and out, giving just a word here and there. As the morning advances, the idle crowd outside murmur their moans and boo-hoos, which faintly reach us as we rake out the coke and run in the coal. Being Englishmen, we don't gird at the novel conditions of our work, but go right on with it, knowing that, failing our exertions, the Trades Hall resolutions of to-night [Aug. 28] would be passed by the dim and flickering candle-light.

## BARRY AND CADOXTON GAS AND WATER COMPANY.

### Inauguration of the Water-Works.

The ceremony of opening the new water-works of the Barry and Cadoxton Water Company, at Biglis, near Dinas Powis, was performed last Wednesday. At the invitation of the Directors, from 70 to 80 ladies and gentlemen were present. The party first visited the high-level reservoir at Pencoedtre, and afterwards the low-level one. They were then driven to the Biglis pumping station, some two miles distant. Here all assembled in the engine-house, where the task of setting in motion the two powerful pumping-engines was gracefully performed by Mrs. Fred L. Davis, wife of the High Sheriff of Glamorganshire and Chairman of the Company, and Miss Hancock, a daughter of one of the Directors. Both ladies were presented, as a memento of the occasion, with a silver key, appropriately inscribed. At the conclusion of the ceremony, the High Sheriff, on behalf of the contractors, invited those present to a luncheon, which was served in a tent adjoining the engine-house.

A short description of these new works will be interesting. The Company was incorporated by the Act of Parliament in 1886, under the title of the Barry and Cadoxton Gas and Water Company, for the supply of gas and water in the parishes of Barry, Cadoxton-juxta-Barry, Highlight, Sully, Merthyr, Dovan, Wenvoe, and Porth Kerry. The first efforts of the Company to obtain a supply of water in the direction of Goldsland were not attended with success; and the Directors called in Mr. J. A. B. Williams, M. Inst. C.E., of Cardiff, to inspect the district and report on the best available sources of supply. His recommendations were adopted; and an Act was obtained in August, 1889. The sinking of the well was forthwith commenced at Biglis; the contract having being entrusted to Messrs. John Aird and Sons, who completed the work in December last. An abundant supply of water has been obtained of excellent quality. Early in January last the inhabitants of Cadoxton and Barry were supplied with water from this well by means of temporary pumps pending the construction and erection of the permanent engines and boiler-houses, and the machinery. These are now practically completed. The engines are vertical high-pressure, triple expansion, direct-acting, Worthington condensing engines, of the most improved design and manufacture. They are in duplicate, and stand on opposite sides of the well. Each engine is capable of pumping into the service reservoirs 200,000 gallons of water in twelve hours. The two boilers are of specially selected steel, and of the single-flued Cornish type, with cross circulating tubes, all of the highest class of materials and workmanship. Space has been provided in the boiler-house for an additional boiler, and in the engine-house for another pumping engine. The engine and boiler houses have been constructed with galvanized corrugated iron and wrought-iron framing. The chimney stack is of brickwork, 60 feet in height. From the well at Biglis a pumping main extends to the high ground at Pencoedtre, a distance of 1½ miles, where temporary covered tanks receive the water, and from thence it is distributed to Cadoxton, Barry Dock, and East Barry. At Pencoedtre, a service reservoir has been built to contain a million gallons, and is now ready for use. From this reservoir all the lower parts of the entire district will be supplied. Another reservoir, to hold a 100,000 gallons, has been built on high ground, and is designed to supply all the highest parts of the district. Each of the reservoirs will have electric communication with the pumping-station at Biglis and also with the Company's general offices, which are now being built adjoining the gas-works, near Barry Dock Station. By this arrangement the height of water in each reservoir will be constantly indicated by the instruments; and the pumping regulated accordingly. About 20 miles of water-mains have been laid down throughout the district. Up to the present time the number of services connected is between 1500 and 1600. The whole of the works have been constructed from the designs and under the directions of Mr. Williams. The contractors for the pumping well and buildings, the reservoirs and for the laying of the mains, are Messrs. John Aird and Sons. The pumping engines and boiler have been supplied by Messrs. J. Simpson and Co., of London; and the whole of the cast-iron pipes and specials by Messrs. T. Spittle, Limited, of Newport. As soon as the contractors have been relieved of their responsibility, the works will be handed over to the charge of Mr. F. M. Harris, the Company's Resident Engineer and Secretary, who has already very successfully carried out the gas-works for the Company near the Barry Dock Station.

## WATER GAS AND COAL GAS AT HARROGATE.

### Sudden Termination of the Water-Gas Lighting.

The water-gas experiment at Harrogate has been brought to an abrupt close; and the lamps and plant have been removed, and the lamp-posts, it is presumed, will be taken down in due course. According to the memorandum entered into by the British Water-Gas Syndicate with the Corporation, the experiment was to continue for three months; and it was expected that this period would terminate on the 6th prox. The water-gas people have not yet condescended to give any definite information as to why they so hastily made an end of the lighting; and, in consequence, various reasons have been put into circulation in the town. It is said (1) that the Water-Gas Syndicate have sold the plant to be erected elsewhere; (2) that as the Corporation lamps will not be lighted for a few days, they do not wish to repeat the experiment of keeping the water gas lighted alone, as was done during the last moon, when the non-diffusibility of the gas was practically demonstrated, to their discomfiture; (3) that, as the action of *Fawkes v. Fox* would come before the Court very shortly, they want to plead the absolute removal of the plant as a bar to the action; and (4) that the Corporation only gave leave for the use of the Montpellier Estate for three months, and as it took a fortnight or three weeks to erect the plant, their time has expired, although three months actual lighting would terminate on the 6th prox. Which of these, or any other reason, is correct we shall probably learn in time.

### The Progress of the Harrogate Gas Company.

Last Saturday week, an article appeared in the *Harrogate Advertiser* giving an historical account of the local Gas Company and various improvements which they are making. Some extracts therefrom will doubtless prove interesting—more especially seeing that this is the first coal gas company in England to be brought into direct conflict with water gas.

Since the year 1846, when an Act of Parliament was obtained, granting the necessary sanction for the formation of a Gas Company, perhaps there is no other body connected with Harrogate which can claim to have striven through the ups and downs of commercial vicissitudes, and the changeableness of contending forces, with greater success than the Gas Company. Having pursued a policy of spirited enterprise and determination, they have—under the successful guidance of a discreet Board of Directors and an able Manager—sprung from a diminutive concern of some £10,000 valuation into a gigantic industry representing a sum of upwards of £100,000. The undertaking has not, however, reached this gratifying state of things without being opposed to hardships and oppositions; for at the very onset the Commissioners, or ratepayers, threatened an opposition, and passed a resolution to apply to Parliament, and to levy a rate for that purpose. After several meetings of the proposed Company, an amicable arrangement was sought to be arrived at with the Commissioners, the then Local Board; but after many endeavours, the negotiations were unsuccessful, and the proposed Company passed a resolution declining any further dealings with the Commissioners, and proceeded with their Bill, which became an Act of Parliament in 1846, as above stated. Considerable difficulty was experienced in obtaining a suitable piece of land. The present site having been offered, and appearing eligible, especially as there was then a probability of a branch from the Leeds and Thirsk railway being brought within a very short distance thereof, was ultimately decided upon by the Company. Another difficulty arose with the Commissioners declining to put down any lamp-posts. The Company, however, resolved that they would furnish the streets with posts, and make no charge to the town for them until they were able to purchase, rather than that the town should be lighted in the wretched manner it then was. There are very few gas companies which have developed so rapidly, and have reduced the price of gas as shown by the following statistics:—

| | Gas Made. | Price. | Gas Storeage Capacity. |
|---|---|---|---|
| 1850 | 2 millions | 8s. 4d. | 30,000 cub. ft. |
| 1860 | 8 ,, | 6s. 6d. | — |
| 1870 | 19 ,, | 5s. 4d. | 55,000 ,, |
| 1880 | 43 ,, | 4s. 7d. | 220,000 ,, |
| 1890 | 100 ,, | 3s. to 2s. 6d. | 570,000 ,, |

During the last decade, the price has been reduced upwards of 60 per cent.; and the demand for gas has been so great as to require the laying down of a 24-inch trunk main from the works, and larger pipes in various portions of the town. The Engineer (Mr. P. H. Wilkinson) says he expected to have been able to make a further reduction possible at the end of the year; but in consequence of the increased price of coal, he can only now do his utmost to stop a rise in price, which he hopes to do if not prevented by unforeseen circumstances. In consequence of the strike last February, the Company were at one time left with only two days' supply of coals; and the Directors decided at once, as far as lay in their power, to obviate any liability of such a calamity in future by erecting a coal-store, having sufficient capacity to store at least three months' supply of coal, with a large margin to allow for the expansion of their undertaking. The Engineer has recommended the Directors, and they have adopted his scheme, to purchase a portion of Battle Crag for the purpose of constructing a road, on an elevation, to the top of the Crag opposite the retort-house, where the coal-store will be erected. By means of three small tunnels below the coal-store bottom, the coals will be removed in the relative rotation in which they were placed therein; that is, the coals first stored will be removed first—a necessary precaution. The coals when removed from the store will be taken in small waggons on rails through two tunnels under Ripon Road and deposited opposite the retorts. This work is now proceeding. All the stone is quarried and dressed on the spot; and it is anticipated that the whole requirements as regards stone for the buildings and for the forming of the roads will be met. The various departments of the staff are well officered, and the employees are anxious to promote the interests of the Company and consumers. The distribution and fittings department are well organized; and a good staff of workmen employed, so that immediate attention is given to all orders or complaints. Cheap burners, giving the most light for the smallest amount of gas consumed, are supplied

at 1d. each. The demand for cooking and heating stoves has been very great, and is still increasing. The Company have upwards of 700 stoves on hire, besides those belonging to consumers, and hundreds of small boiling stoves and other appliances. The Company for several months have been examining into the merits of various systems of water gas and other systems of gas improvement; and when they discover anything of practical utility which can be safely and economically applied, they will immediately adopt it. One of the latest introductions of the Company is that of the Cloudsley patent meter, which, in addition to the ordinary index, is provided with an indicator showing at a glance the value of gas burned to a penny-piece. This system is being opened out, in order that the industrial and working classes may enjoy the benefit of illuminating their dwellings with gas. They will also be able to adopt the gas as a means of heating and cooking at a minimum cost. The Company propose to collect the amounts due weekly.

## THE LATE DISPUTE WITH THE GAS STOKERS AT LEEDS.

**A Reviewer on the Incompetency of the Corporation Gas Sub-Committee.**

The *Yorkshire Post* last Thursday devoted a considerable portion of its space to a review of the municipal work in Leeds during the past year. The review bears the somewhat scornful heading "The Leeds Corporation: Another year of Peddling Incompetency." In the opinion of our contemporary the Corporation does not improve; and their mismanagement of the affairs of the town during the year has caused it to suffer in pocket, in reputation, and in health. Above all the town has been a loser from the "fatuous blundering" of the Sub-Gas Committee in its conduct of the dispute with the gas stokers last July. No municipality in England was ever more belittled by its Corporate authorities than Leeds was, owing to the manner in which the Committee plunged unprepared into a dispute with the gas stokers, by their conduct of such dispute when in it, and by the contemptible manner in which they scrambled out of the quarrel which they themselves had provoked. With a lack of prudence positively startling, of foresight, and of all those other qualities with which important concerns ought to be handled, they entered upon one of the most serious contentions they could possibly engage in; and having let loose the forces of disorder in the town, having disorganized its industries, having exposed the borough to unmentionable perils, and called out the military to quell the disorder, they ignominiously capitulated by doing what they ought to have done before placing the whole community, more or less, in terror—submitting the dispute to arbitration. Following these pungent remarks, the reviewer deals cursorily with the events which led up to the strike. At the beginning of last winter some concessions were made by the Committee to the stokers, which certain members of the Committee seem to have given in bad faith, and with the resolve in their own minds that when the long days of midsummer arrived, and the consumption of gas was at the minimum, they would recall wholly or partially. Notice to that effect was accordingly given at the beginning of June; and at the expiry of a month, the stokers turned out rather than submit to what they considered an injustice. From the Sub-Committee's point of view the time was well chosen, for it was just the period of the year when the borough is least dependent on artificial light. But even then it is a most serious matter for a town like Leeds to be placed in darkness; and the seriousness of such position was greatly increased by the fact that power for a great deal of manufacturing operations is derived from gas-engines, and to deprive the engines of gas was to disorganize many industrial establishments, and throw hundreds of hands out of employment. But this "far-seeing" Sub-Committee was quite alive to the emergencies of the position, or thought themselves so; and before the expiry of the month's notice they had engaged 160 strangers—"the scum," the reviewer calls them, "of the big towns of the country"—to be imported into Leeds to take the places of the old hands. Every reflecting ratepayer in the town regrets and condemns the scenes of disorder and riot that took place. From whatever point of view looked at, they are inexcusable. But how is it to be accounted for that Leeds, with its deservedly high reputation for love of order and obedience to the law, its extraordinary freedom from labour disputes and their consequences, should suddenly become a pandemonium. The answer obviously is that the Gas Sub-Committee failed absolutely to secure public approval in their action towards the stokers. In conceding in the winter what they intended in the summer to recover, there was a meanness and a spirit of petty trickery, says the review, that at the outset diverted popular sympathy to the gas-men, and ensured their success. The general feeling of the town was that it was intolerable that three or four gentlemen representing the power and wealth of a great Corporation, should tyrannously and recklessly use their tremendous advantage in committing a population of 360,000 persons to a reprisal so mean and so paltry as that which was involved in their action. Therein is the secret of their defeat, coupled with the universal feeling in the town which found expression in the question, "Why not have submitted the point to arbitration a month ago?" The proceedings at the Town Council meetings in connection with the strike are glanced at; and this portion of the review concludes as follows: "The return issued by the Borough Accountant states that the Corporation benefit by the strike and the mediation to the extent of £5890 a year; there being a saving on the carbonization of coal over the men's original demands of £5364, and £526 on holidays. It is very doubtful if the leaders of the gas stokers will allow these figures. Indeed, they are totally inconsistent with the claim of the leaders, which was, and is, that the stokers won all along the line—got all they turned out for, if not a little more. But, accepting the Committee's figures as quite accurate, will the Committee and the aldermen who support them answer this question, put in the interests of the ratepayers, and which may well be repeated to every Radical spouter at the municipal meetings that will be held between this date and the 1st of November: If the Corporation gain £5890 by the mediation of Messrs. Beckworth and Harding, what would it have gained if the Sub-Committee had taken resolute steps for submitting the difference to arbitration a month earlier—before Leeds was disgraced in the eyes of the country before 'strangers' were imported and incitement to riot provided; before the borough was placed in darkness for three nights, thousands of hands thrown out of employment, and the community placed in peril; before riot and bloodshed were rampant, and portions of the town were held alternately by the mob and by the military and police? What would have been the saving had all this been avoided?"

## AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED.

The Statutory Meeting of this Company was held last Thursday at the Offices, Nos. 86 and 88a, Leadenhall Street, E.C.—Mr. WALTER KING in the chair.

The SECRETARY (Mr. W. Kight) having read the notice convening the meeting,

The CHAIRMAN said that, as this meeting was the statutory one, no resolution could be submitted to the shareholders; and therefore he only proposed to make a brief general statement with regard to the position of the Company. The late period at which it was started was rather unfavourable, as gas engineers would not consider large extensions and alterations of plant unless the plans were laid before them quite early in the spring. The Directors had nevertheless been successful in obtaining orders from various parts of the country; and numerous inquiries in reference to the Company's system had come to hand, and were receiving the attention of the officers. At the present time several installations were in progress, which the contractors were bound to complete in time for the heavy lighting season now commencing. One of the most recent of the inquiries had been from a large chemical manufacturer in the North of England, who had, to all intents and purposes, as many retorts as a very considerable sized gas company would employ. If the system could be introduced into chemical-works as well as into gas-works, it would open to the Company a larger field than was anticipated when the prospectus was drafted. With regard to the foreign patents, the Directors were, of course, expecting a large revenue from this source; the patent rights for two or three countries being already under negotiation. In this connection, he might specially mention the United States, a deputation from which was expected shortly to confer with the Board as to the purchase of the patents for that country. The only other matter to which he need refer was the validity of the patents. Before the Company was started, the Directors were assured that the patent rights were everything that could be wished for; and they came to this conclusion, not only from their own knowledge, but as the result of the opinions given by very eminent patent authorities. Nothing had since occurred to alter this opinion in the slightest degree. Already applications of various kinds had been made to the Patent Office for modifications of the process; but none, so far, had interfered with the Company's rights. The Board, however, had determined that directly an infringement or a colourable imitation of the patent was started by a substantial man, they would be only too glad to try the case where alone it could be tried—in a Court of Law; and they had not the slightest anxiety as to the result of such an action. He concluded by expressing the hope of the Directors that they would be able a year hence to lay before the shareholders a satisfactory balance-sheet, and pay a good dividend on the capital invested.

Mr. SOLWAY confessed that certain doubts which he had after reading the Company's prospectus had been entirely swept away by the open and satisfactory statement of the Chairman. He was inclined at first to think that the capital was a rather heavy one to go on with, and on which to pay dividends. But now it had been brought home to him that the Company had some very valuable foreign rights for disposal; and it seemed that the sale of these rights would be sufficient to give the shareholders a handsome bonus. He had been especially pleased to hear of the negotiations in progress for the disposal of the Company's patent rights in America; and he had recently heard that the Company's system was receiving considerable attention in the North of England.

Mr. J. STEWART WALLACE congratulated the shareholders on the exceedingly satisfactory statement they had heard from the Chairman. He was interested in the invention, not only as an investment for yielding dividends, but also for the influence it was likely to exert in the direction of the amelioration of the more disagreeable kinds of labour connected with gas-making. He had recently returned from America, and was pleased to report, from his own personal knowledge, that the invention was attracting more attention there than it was here; for the simple reason that the cost of labour in that country, as compared with England, was rather high, especially in gas-works. The consequence was that gas managers in America were far more eager to introduce mechanical appliances than was the case in Great Britain—not from a mere desire to reduce the men's wages, but in order that they might have machinery by which they could rely on the work being done at all times.

Mr. T. C. HERSEY said that he had recently visited the Continent, and found much interest was manifested in the Company's system; and gas engineers in this country had expressed to him the opinion that it was likely to be effectual in putting an end to the labour disputes which had hitherto occurred in gas-works.

The CHAIRMAN, in answer to questions, stated that the invention had been taken up in about 20 cases. Also that the Directors had not yet received any fees, and would not feel justified in drawing more than half the amount specified in the Articles of Association until some considerable foreign rights had been disposed of.

A vote of thanks was then accorded to the Chairman and Directors, and the proceedings terminated.

**The Electric Light v. Gas in Madrid.**—Writing on the 20th inst., a Madrid correspondent said: "Within the last few days two new central stations for the electric light have been started here. There is already a demand for 16,000 lights, of which the two Companies have an equal share. If the light should prove satisfactory, this demand will be largely increased, as great complaints are made against the prices of the Gas Company. The electric light can be supplied at half the cost of gas, which is now charged for at the rate of 9s. per 1000 feet."

## THE EXETER CORPORATION AND ELECTRIC LIGHTING.

### A Provisional Order to be Applied for by the Council.

At the Meeting of the Exeter City Council last Wednesday—the Mayor (Mr. T. Snow) presiding—the question of introducing electric lighting in the city was under consideration. The Exeter Electric Light Company had notified their intention of applying to the Board of Trade for a Provisional Order to enable them to supply the light in the city, and had asked the Council for their consent to the application. The Council did not comply with the request, but instructed the Special Committee on Electric Lighting to enter into negotiations with the Company with the view of ascertaining whether certain provisions could be inserted in the Order, giving the Council the right of optional purchase at a shorter period than 42 years. The Committee thereupon inquired if the Company would be prepared to embody in their Draft Provisional Order a clause conferring upon the Council the power of optional purchase of their works at the end of 14, 21, or 28 years, and, if so, upon what basis. They further expressed the opinion that the price to be charged to the consumer should remain 13s. 4d. and 8d. respectively, as inserted in the Model Order, instead of 16s. 8d. and 10d., as specified in the Exeter Order. In reply to their inquiry, the Committee received a letter from the Company's Solicitor (Mr. C. T. K. Roberts), with the result that the Committee specified the terms upon which the Council should be enabled to exercise the right of purchase at a shorter period than the one above named. They were as follows: That in addition to the value of the plant and works, to be determined by valuation, as prescribed by the Electric Lighting Act, 1888, the Council should, if electing to purchase at the end of 14 years, pay a sum as goodwill equal to the net profits of the preceding five years; if the option were exercised at the end of 21 years, that the net profits of the then preceding three years should be added; and if at the end of 28 years, the net profits of the preceding two years. The Committee also specified that certain changes should be made in the area to be lighted. At the meeting of the Committee last Wednesday, a conference took place between them and the Directors, in the course of which a letter was presented from the Solicitor stating that they could not agree to the relinquishment of their property before the expiration of 42 years, except upon the following conditions: (1) That the option of purchase should not arise at less than 21 years; (2) that the basis of purchase should be the repayment to the Company of all capital then expended, with, in addition, an amount equal to the net profits of the preceding five years if the purchase took place in the first 30 years, and of the preceding three years if it took place between 30 years and 42 years. The Directors consented to the maximum price inserted in the Order being 13s. 4d. and 8d. as suggested; but they did not see their way to consent to the suggested extension of the area within which electric mains must be laid within two years. Thereupon the Committee resolved to report to the Council that the Company's terms were such as they could not, under any circumstances, recommend for adoption. On the Committee's report coming before the Council, a long discussion took place, with the result that consent to the Company's application was refused, and the Council decided to apply themselves for an Electric Lighting Order. The Town Clerk was instructed to prepare the statutory notices; and the carrying out of the resolution was left with the Parliamentary Committee.

## GAS v. ELECTRICITY AT GODALMING.

Our readers may remember that a short time ago the Lighting Committee of the Godalming Corporation visited Bath to inspect the electric lighting installation in operation there, with the view of reporting on the subject to the Corporation, who were contemplating the re-introduction of this system of lighting into the borough. The Committee presented their report in due course; and it was discussed at considerable length at the meeting of the Council on the 22nd ult. The figures submitted by the Committee as to the cost of an installation were given in the JOURNAL for the 30th ult. (p. 709); and it was upon these that the greatest controversy took place. Eventually the matter was adjourned for a fortnight, so that the wishes of the townspeople might be ascertained. In the interval, the Gas Company were asked to send in a tender for the public lighting on a six months' contract, commencing on the 1st prox. This was done; the figure being the same as that contained in the existing contract, which expires at the end of the present month. At the same time a price was given for twelve months' lighting. On the receipt of the letter from the Corporation, the Company's Manager (Mr. S. Bark) brought before the Directors a novel scheme which, we think, went far to settle the electric lighting question for a time. He suggested that they should fix for tradesmen, free of first cost, large gas-lamps suitable for business purposes, and charge for the gas supplied thereto 1s. per 1000 cubic feet less than the usual price; in fact, fit up and serve these lamps on the same principle as that adopted for stoves. The Directors at once agreed to the proposal. Thereupon two of the chief tradesmen, having shops near the Town Hall, were consulted on the matter; and they gladly availed themselves of the Company's offer, and "clinched" the bargain by signing the necessary agreement. Under this the Company agreed to furnish two large lamps and brackets, fixed complete, and to supply them with gas at the rate of 25 cubic feet each per hour during business days and hours—viz., from sunset till seven or eight o'clock, as might be the general closing time—for six months each year, from Oct. 1 to March 31, and on Saturday nights all the year from sunset to 10.30 p.m. They further agreed to light, clean, paint, and keep the lamps in repair for the sum of £4 10s. each per lamp. It was specified that the other party to the agreement should extinguish the lamps at the times stated, and pay the Company £9 per annum in four instalments—two of £3 10s. at Lady Day and Christmas, and two of £1 at Midsummer and Michaelmas; and he also agreed in the event of the contract being terminated before the expiration of ten years, to pay the Company the cost of the lamps and brackets, less 5 per cent. per annum for depreciation. Mr. Bark lost no time in carrying his scheme into effect. The Council meeting at which the electric lighting question was to be further considered, in conjunction with the Gas Company's tender, was fixed for the 17th inst.; and the night before it took place he had five lamps alight with great success. Whether or not this enterprise on the part of the Directors and the Manager influenced the result, we will leave our readers to judge. We need only say that on the morning after the meeting a letter was received at the Company's office, stating that their offer of £4 per lamp per annum, or £2 15s. per lamp on a six months' contract, had been accepted; and an agreement for one year would be entered into. Since then, the Manager has received a number of orders for lamps for one street; and doubtless others will follow. As to the electric light, the Council instructed the Lighting Committee to proceed with their investigations, so that the borough may be in a position to adopt electricity for the public lighting by Nov. 1, 1891. But whatever may occur twelvemonths hence, the opinion is that there is no room for the electric light at Godalming now.

## GAS v. ELECTRICITY FOR THE PUBLIC LIGHTING OF NEW YORK.

In the JOURNAL for April 15 last, we gave some statistics from the report of the Superintendent of Public Lighting of New York (Mr. M'Cormack) for the past year. The following extracts from the same document give an account of the stoppage of the electric lighting towards the close of the year, and also his views on the general subject of this system of lighting the city as compared with gas.

The lighting of our streets and public places by electric lights during the past year has been bad in the extreme; and the people have doubtless been greatly inconvenienced thereby. On three different occasions portions of our city have been shrouded in darkness in consequence of the extinguishment of the electric lights. On April 16 (Centennial week), a large portion of the Brush district was thrown into darkness by the Company because of the cutting of the wires in Broadway by order of the Board of Electrical Control; and the gas-lamps had to be relighted, and afterwards extinguished when the electric lights were again started. On Oct. 11 a Western Union lineman was killed by an electric shock while working on the telegraph wires on the pole at Chambers and Centre Streets, the telegraph wires having been crossed by an electric light wire at some distance from the spot. On Oct. 14 the United States and Brush Companies discontinued lighting; and all streets and parks in these two large districts were thrown into darkness. On Oct. 16 the Mount Morris Company did no lighting; and this district was thrown in darkness. On Oct. 15, 16, 17, and 18, the Harlem Lighting Company shut down, and more gloom was added to the city. In the meantime, the city authorities being enjoined from interfering with the wires of the Electric Light Companies through an injunction obtained from a Justice of the Supreme Court, the Companies improved the opportunity by removing their old "underwriters" wire, and substituting new and heavily insulated wire; and then the lights were again started. On Dec. 13 the injunction was dissolved by the Supreme Court General Term; and on the 14th the cutting of the wires and removal of poles was commenced. On that night the districts of the United States, Brush, East River, Mount Morris, and Harlem Companies were thrown in darkness; all these Companies having shut down. On Dec. 16 the Mount Morris Company started up, and the Harlem Company also started. On Dec. 14 the wires of the North New York Company were cut, and this Company shut down. By these several extinguishments of the electric lights, 56¼ miles of streets and 66 acres of parks were thrown in darkness. In 3·74 miles of streets, electric lamps have been re-lighted; and these remain lighted. In addition to the above-mentioned extinguishments, the police reports show that very many electric lamps were found not lighted during the year; the extinguishments lasting from 10 or 15 minutes to all night in various parts of the city. In some cases entire circuits were temporarily shut off in consequence of some defect at the generating station; and extinguishments have occurred on Broadway, north of Fourteenth Street, and in Madison and Union Parks, which places are lighted from the subway, as also in streets lighted from aërial wires. The extinguishments in December were a very serious affair, and imposed much hard work. The trouble came at an unexpected and inopportune time. The several Gas Companies were unusually busy in stripping, repairing, and caulking again their mains in the numerous streets which were to be repaved during the ensuing spring, in order that there might be no necessity for disturbing the new pavement after being laid. The several manufacturers of lamps and lighting fixtures were naturally pressed with work, as is generally the case prior to the holiday season; and then, when the electric lights were shut off, a sudden and very pressing demand was made on the Gas Companies and manufacturers for more light and lighting apparatus. Consequently this caused me much trouble and some delay in procuring a sufficient number of lanterns for use on the streets from which the electric lights had been cut off. I also found unexpected obstacles in lamp-posts from which the service-pipes had been disconnected by builders, cellar diggers, and others, and by workmen on the electric subway construction; 23 lamp-posts having been found on a short piece of Broadway without gas connections—this having been caused by subway work. However, on Saturday, Dec. 14, the wires were cut, and on the following Monday we had the gas-lamps in all the public parks re-lighted; and by Friday, the 27th, we had the 56 miles of streets re-lighted—4738 gas-lamps having been started again between the 14th and 28th of December, leaving some scattered lamps on side streets adjacent to an avenue still to be lighted. This was all done by the aid and co-operation of the several Gas Companies. In regard to the entire stoppage of work by the Electric Light Companies, I am very firmly of the opinion that some of the streets were unnecessarily thrown into darkness, especially in the lower sections of the city, where the wires had not been disturbed. On the afternoon of the day when the wire-cutting was commenced, I had arranged with the Gas Company for the re-lighting of the gas-lamps in City Hall and Battery Parks for that very night; and this would have been done had I not

been informed by two officers of the Electric Light Company that such action was unnecessary, because the electric lighting would be continued on these parks and on Lower Broadway. On that night I visited the lower sections of the city; and, to my great surprise and indignation, I found the above places in utter darkness, notwithstanding the assurance given me that the electric lamps would be kept lighted. Had the Company continued the lighting down-town, which I am firmly convinced they could have done, we should have had the use of several hundred lanterns for streets up-town.

The streets and public places of this city should never be left in darkness; but at all times of the night, and under all circumstances, artificial illumination should be maintained, and the illuminating material should be such as will afford an absolute certainty of light. Can this be done by means of electric lighting as at present constituted? The experience of the past would seem to indicate that the arc light, in its present stage, cannot be relied upon for artificial illumination with any degree of absolute certainty. It seems to me that there are too many possibilities of interruption. The electric current cannot be stored to any extent, and the lights can only be maintained while the wires are intact and the plant at the generating station is in proper working condition. We have had gas lighting in New York for the last 60 years; and I can find no record of our streets being thrown in darkness in consequence of an accident to a gas-works, excepting on one occasion when the gas-lamps in a few of the up-town streets were not lighted for one night. There have been fires and explosions, but the gas-lamps have remained lighted. There are ten gas-works on Manhattan Island, with two, three, four, and in some cases six sets of gas-mains in the streets. Hence no accident could possibly occur at any one of the gas-works which would tend to deprive the city of gas.

## THE GAS SUPPLY OF CHICAGO.

As mentioned in our editorial columns last week, gas affairs in Chicago (Ill.) have lately given rise to considerable dissatisfaction among the consumers, which has culminated in a declaration of war against the Chicago Gaslight Company—originally the Chicago Gas Trust—a large undertaking which is the outcome of the amalgamation of the several Companies supplying the city. The attack upon the Company has been made by means of a Bill filed on behalf of the Corporation, in the Circuit Court, to forfeit the Charters of the individual Companies, on the ground that the conditions under which these were granted have been violated by the combination of the undertakings, the result of which has, it is asserted, been that the city and individual consumers are charged exorbitant rates for gas. The details of the general charge will be found in the following epitome of the Bill which appeared in a recent issue of an American contemporary, *Light, Heat, and Power*.

The Bill first recites the incorporation of the city and its control of the streets, alleys, highways, parks, and public places within the city, including the power to grant to any companies the right to lay down gas mains, pipes, and feeders, and operate them with such restraints as the public welfare may demand.

The incorporation of the Chicago Gaslight and Coke Company, and the privileges granted it by the City Council, are next referred to. It is also told how the People's Company started in business, and carried it on until it became subject to the control of the Gas Trust. The history of the Consumers' Gas, Fuel, and Light Company, as well as that of the Equitable Company, is likewise recited.

Subscriptions to the capital stock of the Chicago Gaslight and Coke Company amounted to $4,984,200; to the People's Company, $4,400,000; to the Equitable Company, $3,000,000; and to the Consumers' Gas, Fuel, and Light Company, $5,000,000. The rights given to these Companies under their Charters and the City ordinances were granted on the condition, it is averred, that the Companies would, in conducting their business, confer service upon the city and its inhabitants. They were granted to the end that the Companies might, by competition in the ordinary course of business, furnish gas to the city and the people at the lowest market price and of the best possible quality.

The rights granted to the Companies under the ordinances are represented to be of great value, and without them the Companies could not have carried on business. The ordinances granting these rights were passed by the City Council without any consideration except the benefit expected to be derived by the city and the people from the faithful performance by the Companies of their undertaking to furnish gas to the city and the public. In all such work it is especially necessary that open and honest competition should not be destroyed; and the building up of monopolies should be prevented. The acceptance by the different Companies of their respective Charters was upon the implied condition that they would, in due time and in good faith, carry on their business in such a way as to secure to the people the advantages of competition. As a matter of fact, they entered on the exercise of their rights and pursued that plan up to the time when was formed the illegal conspiracy to put an end to such competition, and create a monopoly in furnishing gas.

The history of the Gas Trust Company, now the Chicago Gas Company, is next taken up. It was incorporated, the Bill explains, with a capital of $25,000,000, in 250,000 shares. The works were to be for the manufacture and distribution of gas and electricity, or either, for all purposes. Another expressed purpose for which the Trust was incorporated and organized was purchasing, holding, or selling the capital stock, or purchasing, leasing, or operating the property, goodwill, rights and franchises of any gas company or electric light company anywhere in the State. The second of these expressed purposes for which the Trust was organized is averred to have been illegal and unauthorized. The inevitable result would be, and has been, to secure control of a majority of the stock of all the Companies mentioned above, to stifle and end all competition, and to "erect, establish, and perpetuate a monopoly" in the business; giving to one person or one governing body, only one interest, and that a selfish one—the power to arbitrarily establish and maintain not only the cost or price, but quality of the gas or other light to be used by the Companies.

It is averred that the Trust never intended to construct or maintain any gas-works in the city or in any other place; that, in fact, it never applied to the City Council for the right to construct any works, or lay any mains, pipes, or feeders; that it never did lay any mains or pipes, build any works, or manufacture any gas, or legitimately pursue the objects set forth in its Charter. On the contrary, in violation of the rights conferred on it, the Trust, its promoters, officials, and stockholders conspired and confederated with the officials and certain stockholders of the other four Companies, with the design of illegally acquiring a majority of the shares and stock and absolutely controlling these Companies, so that competition between them might be suppressed. In pursuit of this conspiracy, the Trust obtained control of the four Companies, and has since built up a dangerous and oppressive monopoly. The people and the city are compelled, in consequence, to pay an unconscionable price for gas. Not only is the price exorbitant, but the quality is inferior; and there is no hope for relief so long as the conspiracy and combination exist. The city pays at least $500,000 annually for gas, and the people many millions of dollars; and it is alleged that gas equally good, if not better, could be produced with a fair profit at half the present figure, and would be but for this monopoly. All the defendants, it is said, deny the city's right to terminate the exercise of their Charter-rights by the Companies or the Trust.

How the Trust purchased a controlling interest in all of the four Companies is recited. About April 29, 1887, the Trust effected a disposition with the Fidelity Insurance Trust and Safe Deposit Company of Philadelphia of all the shares of the Companies held by the Trust. This deal, it was pretended, was made for the benefit of the shareholders of the Trust, and to secure the holders of mortgage bonds then or afterwards to be issued by the different Companies. In March, 1890, the Trust and the holders of a majority of the capital stock of the Companies made an agreement with the Fidelity Company by which it was attempted to vest absolutely in that Company the title to all the gas stocks, as if there were no Trust in existence. The power to vote this stock was to remain with the Fidelity Company until the discharge by the Companies of all of their respective bonded indebtedness then existing, or which might be subsequently contracted. The Fidelity Company not only has the absolute powers mentioned, but may render this control perpetual by issuing new evidences of bonded indebtedness, and for ever prevent the possibility of competition; being at the same time independent of the Courts of Illinois. The fraudulent character of these arrangements is further shown by the fact that the creditors and bondholders of the Companies were already secured by mortgages or trust deeds on their respective Companies' property, and the pretended deposit afforded no additional security. The transfer was wholly without consideration. Though the officers of the Companies have surrendered all their rights and franchises to a non-resident corporation, they at present exercise control over the property of their respective Companies.

The ordinances granting franchises to the Consumers' Gas, Fuel, and Light Company and to the Equitable Gaslight and Fuel Company provided that if these Companies should enter directly or indirectly into any combination with any gas company concerning the rates to be charged for gas, or should sell, lease, or transfer their franchise to any other gas company, or should cease for ten days to manufacture gas, their franchises should be lost. Both Companies have violated this provision. The Equitable Company have lost their franchise by abandoning the use of their mains, and using those of the Chicago Gaslight and Coke Company. The Consumers' Gas Company never had an ordinance, but claims to have succeeded to the rights of the Consumers' Gas, Fuel, and Light Company.

The Bill asks for the appointment of a Receiver to take possession of all the capital stock, money, and other assets of the Companies now in the possession of the Fidelity Company, and to operate the Companies under the direction of the Court. The Court is asked to decree a forfeiture of all the rights and privileges enjoyed by the Companies, and a perpetual injunction restraining the exercise of these rights. It is further asked that the transfer of stock from the Companies to the Gas Trust Company or the Chicago Gas Company, and all the dealings with the Fidelity Company, be declared void. The Court is also petitioned to restrain any further acts tending to the illegal combination or conspiracy complained of, and to call upon each of the defendants to make true and complete answer to the Bill.

**The Growth of London.**—A curious feature of London is the regularity of its growth; its houses accumulating at the very nearly fixed rate of 1000 a month. In August of the present year the Water Companies had to supply 765,577 houses; in September the number had increased to 766,797. In the latter month, 11,000 more houses had to be supplied than in September, 1889.

**New Water-Works for Newark-on-Trent.**—The Newark-on-Trent Corporation have decided to establish new water-works; and a boring was commenced a few days ago by Messrs. Le Grand and Sutcliff, of London, in the neighbourhood of Farnsfield, where nearly 100 feet has already been penetrated into the pebble beds of the new red sandstone formation. The work is being carried out under the direction of Mr. Rofe, of Westminster.

**Horncastle in Darkness.**—The inhabitants of Horncastle (Lincs) have experienced serious inconvenience owing to the total failure of the gas supply. In the early part of last week, there were great complaints of the intolerable stench proceeding from the gas. It was not until Wednesday afternoon, however, that it was discovered that a centre-valve at the gas-works had become unworkable, and that the gas was going into the holder, and from thence into the mains, without purification. At half-past ten the supply was cut off, and the town left in total darkness. The defective valve was repaired on Thursday, but not in time to permit of gas being supplied that night. In the evening the streets were in total darkness, business was at a complete standstill, and the shops were closed at an early hour. As gas-engines are used in most of the mills and printing-offices, work in those establishments was at a standstill.

## GAS APPLIANCES AT THE BREWERS' EXHIBITION.

Hotel proprietors being among the largest consumers of gas, it is not surprising that gas lighting and heating engineers pay exceptional attention to their requirements. Probably no class of tradesmen patronize the gas engineer to so great an extent as the publican, who is generally a firm believer in gilded lamps, ornamental brackets, glowful gas-burners, and the like. At the same time, he is no extravagant consumer, but pays due regard to gas regulators, governors, and similiar appliances ensuring economy. All this kind of thing was patent to the eye of the thousands who visited the Brewers' Exhibition at the Agricultural Hall, London, last week. As a matter of fact, the gas exhibits formed a material part of the display, as many as 23 gas engineers entering the lists. Moreover, their exhibits covered a large area of space, and included every imaginable article, from an ordinary burner to a 12-horse power gas-engine. Gas heating and cooking appliances were also in evidence; several hundred of them being collected together—presenting an array of brilliancy and genial warmth.

Dealing first with gas lighting appliances, we noted that, as compared with electric lighting, the exhibits were largely in excess. Of course, Messrs. J. Stott and Co., of Fleet Street, at stand No. 129, were bound to make a splendid show. Several of their patent "Reflex" sun-burners, from 100 to 1500 candle power, produced a very fine effect, and "Stott" gas-governors were demonstrated to advantage. The popular "Meteor" lamp of Messrs. H. Greene and Sons, of 153, Cannon Street, was displayed to advantage at stand No. 100. In the evening, when they were lighted, these lamps proved a powerful rival to the electric light. A matter of importance to those interested in gas lighting was found at the stand of the Brilliant Light Company, who have just started business at 69, Farringdon Road. They show the lighthouse gas-burner of Sir J. N. Douglass, reduced to domestic sizes; and it is claimed that it gives a greater amount of light per cubic foot of gas consumed than any other burner. Certainly it appears to be strong and durable, and ought to work for years without repairs. Another gas-lamp that attracted general attention was one by the Deimel Gas-Light Company, of 86, Gray's Inn Road. The burner in the Deimel lamp is under instead of over the flame; and it does not carbonize or choke. It combines all the advantages of the various regenerative lamps in the market, and can be fitted by anyone as easily as an ordinary burner. The various designs of lamps were exceedingly effective, and commanded great praise. Passing stall No. 115, of Messrs. Botting and Co., of Sidney Street, London, who displayed self-lighting gas-burners and their improved duplex gas-burners, we come to stand No. 25, of Messrs. Dunaway and Son, of 183, Hornsey Road. This firm are advanced in art-metal work, and make a speciality of outside lamps. At stand No. 36, the Incandescent Gas-Light Company, of Westminster, had an artistic display of their well-known burner and "mantle." In some of the specimens, bright reflectors were added—giving a perfect glow of light—while others were arrayed with tinted globes of all descriptions. At stand No. 16, the Thomas Lighting Company, of Carthusian Street, made an effective display of their patent regenerative lamps. The best show of all the lighting appliances was undoubtedly that of Messrs. Wentworth and Co., of Newgate Street, who exhibited Wenham lamps in all sizes and patterns, in addition to the Welsbach lamps, and an assortment of fairy lamps which made the stall most attractive.

We now have to deal with the heating and cooking exhibits. At stands Nos. 124 and 125, Messrs. H. and C. Davis and Co., of Camberwell, had an effective array of their latest patterns in heating-stoves for bar-parlour or kitchen use. Their well-known grillers and hot-plates found many inquirers, as well as such articles as gas boilers, water-heaters, &c. The assortment of cooking-stoves was well displayed; the whole show reflecting considerable credit on the firm. At stand No. 103, Messrs. Ewart and Son, of Euston Road, exhibited bar and kitchen geysers and a geyser bath complete. At stall No. 38, Mr. Fentiman was doing his best for Messrs. T. Fletcher and Co., of Warrington. Their collection included about 20 gas-fires, 7 cooking-stoves, and a host of minor appliances suited to every imaginable purpose. Another good show was that at stand No. 15, of Messrs. Arden Hill and Co., of Birmingham; and Mr. Smith, representing Messrs. J. Wright and Co., Limited, of the same town, displayed specimens of the celebrated "Queen" metal and asbestos gas-fires, and the well-known "Eureka" gas cookers. As to specialities for publicans, the interests of gas were looked after by Mr. W. R. Loftus, of Oxford Street, and Messrs. S. Clark and Co., of Islington. Among other demonstrators who resorted to gas for practical working were Messrs. J. Greenall and Co., of Manchester, who showed their steam washer, which is most valuable for hotel use. Messrs. Bradford and Co., of Holborn, exhibited two gas ironing-machines.

It only remains to notice the exhibits of the leading gas-engine manufacturers. Messrs. J. E. H. Andrew and Co., of Stockport, had four engines running; and the British Gas-Engine Company exhibited a 2-horse and a 1-horse "Cycle," which we learnt find considerable favour with The Gaslight and Coke Company. A very fine display of engineering work was made by the "Campbell" Gas-Engine Company; they having five entries. A 5-man engine of the new type, called the "Gem," which Messrs. Campbell claim to be the smallest engine in the market, is a pretty little motor. At stand No. 165, Messrs. Crossley Bros. exhibited three of the latest type of their "Otto" engines, fitted with a tube igniter. Another good firm—Messrs. Dick, Kerr, and Co.—had a 4-horse "Griffin" and other engines at work. A novelty in gas-engine machinery was that of Messrs. Griffin and Co., of Bath. It was no less than the first portable hydrocarbon gas-engine ever seen. The engine was mounted on four wheels, with travelling carriage and shafts complete. In the rear of a 3-horse vertical engine was carried a gas-generator, which, when filled with petroleum, was sufficient to run the engine for two days. An arrangement, by means of a T-piece, allowed ordinary coal gas to be connected when convenient. Mr. Griffin claims that for the country and the colonies there is a great field for such a gas-engine as he has produced.

Several minor exhibits, such as the "Trent" gas-engine, the new patent double-check regulators of Messrs. Slatter and Watkins, of Little Marlborough Street, and the patent Yankee steam cookers of Mr. Hutchings, of Featherstone Street, all helped to make up a comprehensive and effective exhibition of gas appliances.

## METROPOLIS WATER SUPPLY.

### The Quality of the Water during the Month of September.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 184,412,177 gallons; being at the rate of 30·8 gallons per head of the population as compared with 30·1 gallons in September, 1889. Of the entire bulk of water sent out, 92,932,225 gallons were drawn from the Thames, and 91,479,952 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health, was: Kent, 0·4; Tottenham, 0·8; Colne Valley and New River, 1·1; East London and Lambeth, 1·8; Chelsea, 1·9; Grand Junction and West Middlesex, 2·0; and Southwark, 2·1. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies had quite recovered from the effects of recent heavy floods and had again fully reached its normal summer quality. In every case the water was efficiently filtered before delivery. Of the water obtained chiefly from the River Lea by the New River and East London Companies, that delivered by the New River Company was again distinguished by its high degree of organic purity; ranking in this respect far above any of the other river waters. The East London Company's supply was equal in quality to the best of the Thames-derived waters. Both waters were efficiently filtered before delivery. The deep-well waters of the Kent and Colne Valley Companies and of the Tottenham Local Board of Health were, as usual, of excellent quality for dietetic use. These waters were clear and bright without filtration. The Colne Valley Company's supply was softened before delivery, and thus rendered suitable for washing."

Messrs. Crookes, Odling, and Tidy, in their report on the composition and quality of daily samples of the water supplied to London last month, say: "The improvement manifest in the London Water Supply on or about the middle of August, to which we have already directed attention, was more than fully maintained during September. The colour-tint of the Thames-derived water during the first half of August was as brown to blue 20 : 20; during the latter half of August as 14·1 : 20; while during September the average colour tint was 11·5 : 20. The same fact is clearly indicated by a comparison of the results furnished by the oxygen test. Thus, while during the month of August an average of 0·065 grain of oxygen was required per gallon, during September only 0·044 grain of oxygen was needed. These results show an unbroken purity of supply, even under the severe conditions consequent on flood, and an almost unprecedented rainfall. The marked uniformity in the composition of the various waters during the past month is specially noteworthy. Further, the complete freedom of the numerous samples examined from any trace of suspended matter is to be remarked."

**London Gas Companies and the Provision of Churches in their Districts.**—A short time ago an appeal was made by the Vicar of Barking to the Directors of The Gaslight and Coke Company for assistance in connection with a scheme for providing a new church for his parish. The Directors did not, unfortunately, see their way to acceding to his request. Referring to this matter last week, a correspondent of the *Standard* called attention to the fact that, when the Bishop of Rochester made an appeal, a few years ago, for additional churches for South London, the South Metropolitan Gas Company took up the matter in a favourable spirit. Though unable, as a Company, to apply funds to build churches, the Directors did not ignore their responsibility, but sent circulars to all the shareholders inviting them to contribute to the Bishop's Additional Churches Fund, which by this means received considerable support. "Surely," he added, "The Gaslight and Coke Company might follow this good example."

**Batley Corporation Water-Works.**—It may be in the recollection of some of our readers that in May last, the Batley Corporation, on the advice of Mr. G. F. Hill, took out of the hands of the contractors the work in connection with the arm trench of their Ramsden reservoir, and entrusted it to their own Manager (Mr. O. J. Kirby, C.E.). The trench is being carried out in three sections; and will cost about £30,000. When the change was made, it was thought by many that the work could only be done satisfactorily by being let to another contractor. But according to a report recently presented by Mr. Hill to the Water Committee, and submitted to the Council at their last meeting, the progress made since the Corporation took up the work has been most gratifying. The trench has been sunk to its bottom (from the end of the last length finished by the contractors) for a distance of 66 yards; the average depth below the surface of the ground being 78 feet. For this length a satisfactory bottom was found—being a continuation of the same stratification in which the last length was founded. The excavations of the remaining length of the trench—about 59 yards—have been sunk to an average depth of 70 feet below the surface. There is a spring of water at the end of the trench, which changes its position from one side to the other as the excavations proceed. The spring is in communication with the reservoir. Alderman Middlebrook, in moving the confirmation of the Committee's minutes, laid emphasis on Mr. Hill's report that the works had proceeded satisfactorily since the Corporation took over the contract, because, he said, it reflected special credit on their Water-Works Manager. The minutes were unanimously passed.

## THE CORPORATION OF LONDON AND THE METROPOLITAN WATER SUPPLY.

### The Committee's Report Adopted.

A Special Meeting of the Court of Common Council of the City of London was held at the Guildhall last Tuesday—the LORD MAYOR (Sir Henry A. Isaacs) in the chair—for the purpose of considering the report of the County Purposes Committee on the subject of the water supply of the Metropolis and the recent public inquiry thereon. A full abstract of the report was given last week (p. 860).

Prior to the debate, a letter was read from the Clerk to the London County Council (Mr. De la Hooke), stating that the Special Committee of that body appointed to consider the question of the water supply of the Metropolis had been directed to enter into communication with the Corporation, with a view to the promotion next session of a Bill, to be introduced jointly by the two bodies, for revising the methods by which the Water Companies are now charging on the basis of the rateable value of the property supplied, and for giving power to the County Council and the Corporation to establish an independent supply. The Committee wished to know whether or not the Corporation would confer with them on the subject. At the last meeting of the County Council a resolution was passed authorizing the Committee to enter into negotiations with the Water Companies for the purpose of ascertaining on what terms they would be prepared to dispose of their various undertakings, in the event of Parliament giving power to the Council to take them into their own hands. The letter was referred to the County Purposes Committee to consider and report.

Mr. ROSE-INNES, in moving the adoption of the report of the County Purposes Committee in regard to the water supply, said the result of the inquiry showed that there was a general consensus of opinion that something must be done at once in the matter, and that the Corporation should take the initiative by seeking legislative powers at the earliest possible moment to enable them to deal with it. The Committee had treated the subject as practical men, and from a purely businesslike point of view; but there seemed to be in the minds of some of the public a misapprehension as to what their proposals were. They did not recommend the appointment of a Royal Commission to inquire into the matter. They simply suggested the creation of a Water Commission on the lines of the report. If they had to take water in the future from other areas than that of the Thames watershed, it was suggested that the local authorities of those areas should be represented. The Commission would in that way be formed of representatives having control over the different areas from which the water was taken. It was clear that the Commission must have power, if need be, to arrange for an alternative supply. At present there was no other body than the Corporation to move in such a matter. The Government had not the time; and the London County Council, with the best intentions, had no funds to promote such a measure as that suggested. It was therefore for the Corporation to take up the subject, and give notice early next session of the Bill proposed. Every year's delay would increase the amount to be paid to the Companies, because not only would the rateable value of the property supplied increase, but the number of new houses served was larger every year. If the matter was not dealt with at once, not only would the rates be heavier, but the price payable for the acquisition of the water supply would be reckoned on a more extended basis. It was not the case, as had been stated, that the Committee proposed to buy out the undertakings of the Companies for £33,000,000. On the contrary, it would be for the new Commission to control and arrange the price. He believed that if the Commission were fairly representative of all the areas affected, Parliament would confer upon it the powers suggested.

Mr. BEDFORD drew attention to the evidence of Sir R. Rawlinson, as to the alleged polluted condition of the water supply of the Upper Thames; and asserted, as a member of the Conservancy Board, that to his knowledge the statement was untrue. He suggested, looking to the importance of the subject, that the debate should be adjourned until the members had had an opportunity of considering the report.

Mr. PRICE said that, much as he desired to see some improvement in the water supply of London, he thought the time had not arrived for authorizing the promotion of a Bill, as proposed; and he moved, as an amendment, that the consideration of the report should be adjourned until the Corporation and the London County Council had had a conference on the subject, as proposed by the latter body. Otherwise it would appear, he said, that they were desirous of stealing a march on the County Council.

Mr. ANDERSON seconded the amendment.

Mr. HORA said he hoped the Court would not make the mistake it did twenty years ago, when it was disposed to take the necessary steps to buy up the water-works. It then delayed to do so; and, in consequence, the price would now be £15,000,000 or £20,000,000 higher than then. It would be almost criminal, in his opinion, if the Corporation again postponed taking action; and therefore he hoped the Committee's report would be at once adopted, and the necessary notices given for a Bill.

Mr. H. CLARKE said many millions were at stake, and the same prudence which members would exercise in their own affairs should guide them in dealing with a matter so vitally affecting the interests of the ratepayers. He therefore deprecated a too hasty decision being come to. They were all unanimous that the present state of things should not be allowed to continue a moment longer than could be helped; but what they were not so unanimous about was the best way of remedying it. It was useless, he thought, to waste time by attempting to negotiate with the Companies. Then came the question whether they ought to have an independent supply, under popular control, side by side with that of the Companies. He thought it would be fairer and more just to buy up the existing undertakings on what might be considered equitable terms. He was doubtful as to the wisdom of the proposed constitution of the Water Commission. He thought the representatives should be directly elected by the ratepayers. He should be loth to see the matter handed over to the London County Council, who already had enough work on hand.

Mr. G. N. JOHNSON opposed the adoption of the report; and, in doing so, said it was the opinion of experts that the resources of the Thames had been taxed to the utmost, and that this had been done in the case of the New River Company. The Water Companies had done all they could within human bounds; and some of them would be very glad to receive a *bonâ fide* offer. He urged that the Corporation would be in no better position if they became the purchasers of the water undertakings; and said he failed to see any comparison between the position of affairs at Manchester and Glasgow and in the Metropolis. On the other hand, he believed that by taking over the works of the Water Companies they would be taxing the patience of the ratepayers. In Glasgow the population was 360,000, and the cost of the works was £750,000, or £2 per head; but in the present case it would be £6 per head. An alternative supply was the only means of obtaining reasonable terms from the Companies. He believed that the relief of the ratepayers would not be far off if an attempt were made to obtain an alternative supply; and if they possessed 10, 20, or 30 millions sterling, let it be used in maturing such supply, so that they might protect themselves against the Companies and get the ratepayers out of their present difficulty.

Mr. W. H. PANNELL thought the report dealt with the interests of the existing Companies fairly and equitably, by suggesting that those interests should be the subject of arbitration.

Mr. A. A. WOOD also supported the report; but advised the Court to go hand-in-hand with the County Council in the matter.

Mr. ROSE-INNES, replying to the remarks made by the previous speakers, said, in reference to Mr. Bedford's opposition, that he regretted he had not given the Committee his assistance; and he also reminded him that the evidence he had criticized was not given by Sir R. Rawlinson, but by Mr. Jabez Hogg. He pointed out, too, that the report did not endorse any attack that might have been made upon the Thames Conservancy. He spoke of the ability displayed by Sir Guyer Hunter, M.P., in the conduct of the inquiry; and answered Mr. Bedford's questions by saying that Mr. Halse, also a member of the Thames Conservancy, had put in evidence of a very valuable character, for which he thanked him. In reply to Mr. Price's remarks, he could assure him that a draft of the Bill should be shown to the members of the Court, and also to the members of the London County Council. He hoped Parliament would assist them in carrying their point, which would certainly add another gem to the coronet of the Corporation.

Mr. PRICE said, after this reply, he would withdraw his amendment.

Mr. MALTHOUSE, who was frequently interrupted, moved an addition to the report, to the effect that a clause should be inserted that an independent supply should be obtained, provided the Water Companies' undertakings could not be purchased on reasonable terms. He contended that a supply from Wales could be had at one-third of the amount proposed as the purchase-money of the Companies' properties—at, in fact, a cost of £10,000,000.

Mr. TRELOAR seconded this amendment.

On being put to the vote, it was rejected by a large majority, and the report of the Committee adopted.

### The "Financial News" on the Purchase Question.

In a long article which appeared on Monday last week, the *Financial News* discussed the question of the acquisition of the Water Companies' undertakings by the Corporation in conjunction with the County Council, or by the latter body alone. After a few general introductory remarks, our contemporary expressed the opinion that the whole matter might be considered from two standpoints—viz., the desirability and the practicability of a purchase scheme. The former point is soon disposed of by the writer of the article, by the remark that the argument in favour of acquisition is "irresistible." The conclusion is supported by the cases of Glasgow, Liverpool, Manchester, Birmingham, and other large towns, where the water supply is in the hands of the municipal authorities. On the broad principles of policy, then, it seems to our contemporary that "London has everything to gain and nothing to lose, so far as cheapness, efficiency and quality are concerned, by placing under the control of the Local Authorities the eight great Companies who perform the task of supplying its 6,000,000 of people with water." The question of who is to undertake the work is passed over as immaterial to the inquiry. It is in connection with the practicability of such a project that differences of opinion are most likely to arise; and practicability, in this sense, chiefly resolves itself into a matter of money. It would, for instance, be a serious objection, although possibly not a fatal one, to the execution of the plan if it were found that it would involve the ratepayers in a material increase of their burdens. It is admitted that the tendency is undoubtedly for the cost of local government to progress at somewhat too rapid a rate, as exemplified to a painful extent in the case of the London School Board. It would probably, it is remarked, arouse the resentment rather than the sympathy of the ratepayers if any formulated proposal for buying up the water-works were based upon conditions of purchase which necessitated the addition of an appreciable burden to the rates. Reference is made to Sir John Lubbock's estimate of an extra 4d. in the pound on the rates which the purchase would entail; and it is remarked that if he is right, "it can hardly be expected that the County Council will receive a spontaneous, or even a very enthusiastic, mandate from the ratepayers to proceed with the business" But the writer undertakes to show that Sir John's view is not correct, and that so far from an addition to the rates being required, the revenues derivable from the consumers on the existing basis would enable the Council to make the purchase and pay off the whole of the loan that might be raised for such a purpose, within the stipulated period, without imposing any extra cost upon the ratepayers. In support of his case, he makes use of some statistics compiled, at the instance of the conductors of his paper, by Messrs. F. Mathieson and Sons. Starting with the sum of £14,445,676 as the capital of the London Water Companies, the question of what should be the basis of purchase is discussed. The system of annuities, which was followed in Glasgow and Birmingham, as well as at Sheffield, seems to the writer hardly feasible, or likely to meet with favour in London. He considers the proper basis would be the payment of a lump sum down. The question is what that sum

should be. This, of course, would depend upon the market value of the undertakings at the present time, which is put as follows :—

| | |
|---|---|
| Chelsea | £2,601,845 |
| East London | 4,505,991 |
| Grand Junction | 3,018,274 |
| Kent | 2,224,088 |
| Lambeth | 3,749,776 |
| New River | 10,930,800 |
| Southwark and Vauxhall | 3,359,204 |
| West Middlesex | 3,334,462 |
| Total | £33,724,440 |

This estimate differs very slightly from that arrived at by Mr. S. Wood (of Messrs. Alfred Lass and Co.), who gave the value of the ordinary capital of the Companies at £27,726,473, and that of the preference and loan capitals as £5,718,033—together, £33,444,506. The actual value of the eight water undertakings now is about £4,000,000 in excess of what was considered sufficient to buy them out-and-out a few years ago. Dealing next with the revenue resulting from the employment of the capital sum above mentioned, the writer, working upon the half-yearly accounts of the Companies, arrives at the figure of £1,216,891. He then proceeds to inquire how the purchase question is to be grappled with financially. He takes it for granted that when the works come under one management, the general expenses would be decreased; and he also assumes that the County Council would be able to borrow money at 2¾ per cent.—issuing the loan at 91¾. The Corporation Committee, guided by the Chamberlain (Mr. B. Scott), based their calculations on a loan bearing interest at 3 per cent.; and on this basis they made out that the net profits of the Companies in the year 1889-90, amounting to £939,806, would pay the interest on the loan (£831,794), and leave a balance of £108,012 available for a sinking fund or other purposes. Our contemporary feels pretty certain that the County Council, if they took the water question in hand, would have no difficulty in raising from £30,000,000 to £40,000,000 at about £2 14s. per cent. interest; but it is pointed out that an essential condition of the loan would be its repayment in a specified number of years—say, 60. The writer of the article takes this limit in dealing with the question of paying off the loan; and he gives the following table showing exactly the amount of stock—in other words, what proportion of the loan—would be necessary to purchase the undertakings in each case, the interest which such payments would involve, the balance that would be available annually for the sinking fund, and the number of years in which the debt could be redeemed :—

| | Amount of 2¾ per cent. Loan at 91¾. | Interest per annum. | Balance available for Sinking Fund. | Years in which Debt could be redeemed. |
|---|---|---|---|---|
| Chelsea | £2,835,799 | £70,894 | £20,852 | 60 |
| East London | 4,908,437 | 122,711 | 32,723 | 62 |
| Grand Junction | 3,289,672 | 82,242 | 39,370 | 46 |
| Kent | 2,424,075 | 60,602 | 31,292 | 43 |
| Lambeth | 4,084,225 | 102,106 | 48,528 | 46 |
| New River | 11,668,417 | 291,710 | 48,161* | 79 |
| Southwark and Vauxhall | 3,661,260 | 91,532 | 34,354 | 53 |
| West Middlesex | 3,634,291 | 90,859 | 48,957 | 44 |
| Total | £36,506,176 | £912,654 | £304,237 | 56 |
| Total without the New River Co. | £24,837,759 | £620,944 | £256,076 | 49 |

* Or £52,286.

The article concludes as follows : It will be seen that the amount of loan is necessarily somewhat larger in each case than the present market value, because the question of the sinking fund has to be taken into consideration. The total annual charge, therefore, for acquiring the whole of the Companies would be, in interest and sinking fund, £1,216,891; and that, as already shown, is the net revenue of the Companies at the present time. We have consequently satisfactorily proved that, even taking in the New River Company—which is the costliest of the whole lot, and would require the longest number of years in which to repay the loan—the average number of years for repayment is 56; without the New River Company, it would be only 49. The apparent conclusion from this is that the County Council would have no difficulty whatever in dealing with the whole financial question without inflicting any additional burden upon the ratepayers, provided they could issue their loan at the rate of interest and at the issue price we have named. It may be interesting in this connection to set forth the negotiator's recommendations as to the terms for the various Companies in the earlier proposal that was made to purchase: Chelsea, 43 years' purchase; East London, 45 years; Grand Junction, 43 years; Kent, 42 years; Lambeth, 41 years; New River, 40 years; Southwark and Vauxhall, 43 years; West Middlesex, 31 years—an average of 41 years. The business would, therefore, be much costlier now than it was then. . . .

It is not necessary, we think, to enter at any length into the possible future of the water-works if they were grouped together under representative control. What has been achieved in other towns should be an example and an incentive to the greatest city in the world. . . .

The only conclusion we can come to after studying the experience of other centres is that it is a reflection upon this rich Metropolis that it should have allowed so essential a matter as its water supply to remain so long in the hands of private capitalists. These capitalists, however, have vested interests; and although the emancipation of the water supply from their control is imperative, yet the principle of spoliation is not one that is likely to find favour at the hands of the County Council. Holders of the Companies' stock have a right to expect—and they, no doubt, will expect—to receive the full market price in any compulsory transaction to which they have to submit. It is, however, enough for our purpose to have shown that such compulsory purchase can be carried into effect, and that the revenues derivable from the undertakings will be sufficient to pay the interest and amortization charges of the necessary loan.

**Cape Town and District Gaslight and Coke Company, Limited.**—The letters of allotment in this Company have been posted.

## THE WATER SUPPLY OF PARIS.

In the course of an article dealing with the sanitary condition of Paris, as affected by the present systems of water supply and sewerage, the *Engineer* recently made the following remarks :—

There is no Government department which has been more active in France during the past few years than that of public works; and the engineering enterprises undertaken under its auspices have undoubtedly done much to develop the internal resources of the country. But little has been done in the important matter of sanitation; and at the present moment Paris, with its magnificent highways and bridges, is provided with a system of sewerage of the most primitive order. Ineffective sewerage and a bad water supply are, in truth, the principal factors in determining the very much higher death-rate of Paris than of London; and to realize how bad these are, it is only needful to regard this discrepancy in the mortalities of the two cities, in relation to the fact that the other conditions of Paris are far more favourable to a low death-rate than are those of London. The question of the Parisian sewerage will have to be dealt with before very long; but works are at present in train for providing a more satisfactory water supply. A good deal of progress has already been made towards this end, of which the latest step was the recent construction of the reservoir at Montmartre.* Even during the past summer, however, the inconveniences of the present system of water supply have been severely felt. The service of pure spring water carried by aqueducts into the city is not sufficient to meet all the necessities of Paris; and when it is found insufficient—a thing which generally occurs during the hot and dry months of the year—it is necessary to substitute Seine water for some weeks together. This step has been taken this year, and the discontent which it evoked perhaps had something to do with inducing the Chamber to approve the long-debated scheme for bringing an adequate supply of "source" water into Paris. This is to be done by means of an aqueduct, which will transport the waters of the two small streams, the Avre and the Vigne, from their source in the department of Eure-et-Loir into Paris. The plans for this work have now been all prepared, and the necessary legal steps for the acquirement of land have been taken. The aqueduct will run through the two departments of Eure-et-Loir and Seine-et-Oise, and will discharge into an enormous reservoir to be built at Montretout. The most interesting part of the work, from an engineering point of view, is the tunnel which is to convey the water under the heights of Marly and the Park of St. Cloud. This tunnel will commence upon the borders of the Park of Versailles, and will run as far as Villeneuve-l'Elarg—a distance of about 4¾ miles. Its depth below the ground will in some parts of the route exceed 215 feet. Work has already been commenced on this portion of the undertaking. Fifteen shafts have been sunk at distances of about 550 yards. This preliminary work has not been carried on without difficulty. It is found that the sandy soil of which the hills on the west of Paris are composed is completely permeated with water at a little distance from the surface. Operations are therefore carried on by sinking a metallic lining, consisting of two concentric cylinders, secured together by iron braces, and strengthened by masonry. At the bottom the two cylinders join; and they terminate in a steel attachment with a cutting surface, which sinks into the wet sand under the weight of the cylinders. Inside this tube, which is 10 feet in depth, workmen can safely carry on the work of removing the soil; and with its progress the tube is lengthened out by the addition of new ones. Other noteworthy features of the works in connection with the scheme are the construction of an iron aqueduct across the Seine bridge, the erection of new machinery at Clichy, the laying of an extensive series of pipes through Paris, and the building of the Montretout reservoir. This reservoir will contain three compartments on the same level, each of them holding 4¾ million gallons of water; and the entire capacity of the reservoir will be sufficient to supply Paris for three days. It will be covered with brickwork arches turfed over. On the whole, it may be hoped that the Parisians are at last in a fair way to escape from the compulsory limitation of water consumption to which they have so long been condemned.

## EARLY HISTORY OF THE NEW YORK WATER SUPPLY.

Our readers may remember that the Croton Aqueduct, which has for some years been in course of construction, to convey water to New York, is now finished. It may therefore be interesting, in connection with this event, to reproduce, from one of the daily papers of the city, the following facts relating to the original supplies.

It was not long after the early settlement of New York that the want of a sufficient water supply was felt. Wells were at first the only source of water. Up to 1658 there were no public wells, the inhabitants supplying themselves from private wells on their own premises. In 1658 a public well was sunk in front of the old fort. Nineteen years later, six additional wells were ordered; the inhabitants of the streets where they were made defraying the expense. Seven more public wells were ordered in 1687; and the City Government undertook to pay half the expense. No person could use a well until he had contributed towards the cost of it. It was a great event when, in 1750, pumps came into use. Afterwards, a General Act was passed to enable the city to raise a tax for the construction and repairing of the public wells and pumps.

Some of the wealthier inhabitants at this time preferred to send to the suburbs for their water; that in the wells not being good. They sent out to the Fresh-Water Spring, known at that time and long afterwards as the "Tea-Water Spring." Just before the Revolution, the vicinity of the spring became a popular and fashionable resort, where various beverages, mixed with pure spring water, could be obtained. A pump was put up over the spring, and a sort of park was laid out around it. The people called this resort "The Tea-Water Pump Garden." Water was bartered for like any other commodity. Vendors sold it by contract, or at 1c. or 1½c. per pail. Knapp's tea water, which

* See JOURNAL, Vol. LV., p. 195.

was drawn from a spring near the old White Fork, at Tenth Avenue, yielded a good living to a great many men.

A Company styled the "New York Manhattan Water-Works," was incorporated in 1799 for the purpose of supplying the city with pure and wholesome water. This was the year after the yellow fever had ravaged the place. But the Company seemed more interested in banking money than in furnishing pure water. Their works consisted of a well, two steam-engines, a reservoir, and a couple of small wooden receptacles. To Christopher Colles, however, is given the credit of having suggested, in 1774, the scheme afterwards adopted by the Manhattan Company—that of digging large wells and pumping water from them into reservoirs. Colles even looked so far ahead as to see the advantages of communication uniting the great lakes and the Atlantic Ocean. In pursuance of his plan, a spacious reservoir was built on Broadway.

These reservoirs and wells did not succeed in giving New York a sufficient water supply; and in 1819, Robert Macomb asked permission to furnish the city with water. No positive action was taken, however, until 1829; when it was resolved by the Board of Aldermen to establish a well and reservoir in Fourteenth Street. There were at the time 40 public cisterns in the city. Half-a-dozen companies were incorporated in succession, having in view the furnishing of pure water to the city; but they met with no success. In 1830, an iron tank 43 feet in diameter, 20 feet high, and containing 305,422 gallons of water, was completed at Thirteenth Street and Fourth Avenue.

Francis B. Phelp's memorial of May 17, 1830, was the first definite proposal for the introduction of Croton water into New York. That year it became necessary to build sixteen more cisterns. Colonel De Witt Clinton favoured the Croton project; and in 1834 the Common Council obtained from the Legislature a law authorizing a loan of $2,500,000 to create a stock called the "Water Stock of the City of New York." Under the Chief Engineer (Mr. D. B. Douglas) and four District Engineers, the work on the Croton Aqueduct was begun in the spring of 1837. In 1839, the Legislature authorized the erection of High Bridge, on which to convey the Croton over the Harlem River. The total cost of the aqueduct was $11,452,619. Extensive preparations to celebrate the completion of the aqueduct were begun by the Fire Department; and the city appropriated $2000 for the expense. At sunrise on the day of the celebration a hundred guns were fired, and all the church and public bells were rung. At 9 a.m., in front of the Ctiy Hall, Mayor Morris presented a banner to the Fire Department. High Bridge was finished in 1848, and ten years later the large reservoir in Central Park was begun. It was completed in 1862. The two 36-inch pipes crossing High Bridge were replaced in 1861 by a large 7½-feet iron pipe, equal to the full capacity of the aqueduct. The high-pressure works at High Bridge were made available in 1870. The storeage at Boyd's Corner was completed in 1873; and the Carmel reservoir became available in 1878. Up to 1879 the total expense for everything connected with the water supply had been $35,820,081.

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**A "New" Gas.**—At the Meeting of the Court of Common Council ast Tuesday, a letter received from a Company which proposes to introduce a "new" gas, said to be cheaper than that now in use, and also "cheaper and better than the electric light," was referred to the Streets Committee.

**The Kendal Corporation and the Gas and Water Works.**—The question of purchasing the gas and water works from the local Company has long occupied the attention of the Kendal Corporation, and now decided steps have been taken. The Corporation at a private meeting last Tuesday made an amended offer to the Company for the purchase of their property at the price of £82,840—for the share capital, £77,440; loans, £5400. The Corporation do not bind the Company absolutely to this amount, which is offered in the hope of coming to terms with the Directors.

**Gas Cookery Lectures at Dalston.**—Under the auspices of The Gaslight and Coke Company, Mrs. Page delivered during the past week, at the Colosseum, Dalston Junction, successful lectures, both afternoon and evening, on the advantages of cooking by means of gas-stoves. The lectures which have been given under the superintendence of Mr. S. J. Ball, the Chief Inspector for the Company's Central Division, and personally managed by Mr. Stubington, were well attended. The interest of the public was particularly manifested on Thursday last, when the lecturer cooked an entire dinner, consisting of several courses; the gas-meter on the platform registering the consumption of gas at 1½d. The large interior of the building, which is capable of seating 3000 persons, and which was brilliantly lighted at night-time, enabled several makers of gas-stoves, &c., to display their wares, with, we believe, good effect from a business point of view. The Schülke Gas Lighting Company also had some of their lamps on view.

**The Water-Works Purchase Question at Andover.**—The Andover Town Council and the Water Company cannot come to any agreement with regard to the transfer of the property of the latter. According to a letter written by the Secretary of the Company, and read at a meeting of the Council last Wednesday week, the shareholders authorize the Directors to sell the works, "but subject to the existing mortgage debentures and all other liabilities to which the said property is or may be subject to at the time of sale, at and for a price or sum to be ascertained and fixed by two arbitrators, one to be appointed by either party or their umpire in the usual way, the costs of such arbitration and transfer to be borne by the said Council, and upon such other terms as may be agreed on between the Directors and the Council." From the report of the discussion, it appears that the Councillors were not altogether pleased with the resolution of the shareholders; and after much discussion, they adjourned the consideration of the matter till the following Friday, when they unanimously agreed to purchase the works upon the terms offered on May 27 last—viz., to pay £6500 for the undertaking as a whole, this sum to include all compensation to officers, &c., but subject to the payment of the existing mortgage debentures of £3000, and interest at 4½ per cent. thereon, the details for carrying out the purchase to be embodied in an agreement, to be prepared by Mr. Lamb, the Company's Solicitor, and submitted for the approval of the Council.

## NOTES FROM SCOTLAND.

**From our Edinburgh Correspondent.**

EDINBURGH, *Saturday*.

The Aberdeen Town Council, I am happy to say, effectually extinguished, at their meeting on Monday, the proposal of the Finance Committee, mentioned in my "Notes" last week, to take power to apply profits derived from the Corporation gas undertaking to city improvements. In the discussion upon the subject, only one speaker besides the mover and seconder, declared himself in favour of the Committee's suggestion so far as it related to the gas profits; but no fewer than eight speakers declared themselves against it. So persistently was it denounced by certain members of the Council, that the Lord Provost at last requested Treasurer Morgan, who had introduced the matter, to withdraw it. This Mr. Morgan consented to do; and the Council then adopted the remainder of the Committee's report, which dealt with the extension of the city boundaries and the like. In laying the subject before the members, Mr. Morgan submitted, as reasons for taking the step which the Committee proposed, that the Council had held the gas undertaking for nearly 20 years, during which time they had spent £102,000 on the works, of which sum £87,000 had been repaid, so that the works now stand in their books at little more than their original cost. While this has been done, the price of gas has also been reduced from 5s. 5d. to 3s. 6d. per 1000 cubic feet. The Committee therefore came to the resolution—certainly an absurd one—that the undertaking should be "worked at a profit;" and they thought that an average of 5 per cent. on the ordinary consumers' accounts would not increase it more than from 1s. to 1s. 6d. per annum, and would yield about £2500 a year. Other necessaries of life were not bought at prime cost; and why should this be? There was nothing very startling or revolutionary, Mr. Morgan thought, in their proposal. The Council, however, considered differently. Mr. Mearns regarded it as "a little shady;" Mr. Gordon thought it "about the worst piece of political economy which had ever been engaged in by any Committee of the Council since he became a member of it." Baillie Duff considered it would be "one of the greatest blunders they could be guilty of, because they would make people use paraffin and electric light;" and Mr. Findlay "had a decided objection to indirect taxation," and also to the proposal because it was "neither more nor less than one of punishing the poor consumer to save the rich ratepayer." The general feeling against the resolution was stronger than the above extracts show; and it was dropped. It says a great deal for the intelligence of the members that they saw through the sophistries of the Finance Committee, and were able at one sitting to dispose of so objectionable a matter. It was so effectively "scotched" on this occasion that I cannot conceive of anyone having the hardihood to bring it forward again.

Before leaving Aberdeen, I may mention that the Gas Committee of the Town Council met on Wednesday, when Mr. Pratt introduced the question of the deposits which are needed before a supply of gas will be given. At present full security is required, or deposits at the rate of 10s. for the first burner, and 5s. for each additional one. This Mr. Pratt considers to be too high, and he has given notice of a motion that a supply of gas be furnished on a money deposit, which he proposes to reduce, making the lowest rate 5s., and that deposits be returned after three years, with interest on sums exceeding 20s. The peculiar feature of the question is that in Aberdeen, with its high rates of deposit, bad debts amount to 13s. 5d. per cent.; whereas in Glasgow it is 8s. 9d., and in Dundee only 2s. 2d. per cent.

The questions relating to the gas supply in Dunfermline, to which I referred last week, have raged with a good deal of violence during the week, at meetings of the electors. Mr. Hoey, a member of the Council, who is the prime mover in the agitation, has prepared and published an elaborate table, which shows that, while the Dunfermline Gas Company were bound by their agreement with the Police Commissioners (entered into in 1872), to charge for gas consumed in the public lamps the average price paid in Edinburgh, Glasgow, Greenock, Paisley, and Kirkcaldy, their charges had all along been higher. The accuracy of the table is, however, disputed, and that rightly, as I can testify with regard to Edinburgh. I have just looked up my old receipts, and find that the figures relating to this city are incorrectly given. But, apart from that, there is a question which Mr. Hoey entirely overlooks, and that is meter-rents, which the Company may claim to be entitled to include in making up their charge. I understand the Company admit that after the quality of gas was reduced in Glasgow, they dropped that place out of the list of towns, and made their charge upon the average of the other four. Some of the speakers at the electoral meetings thought the Company had taken advantage of the Commissioners; and Mr. Hoey informed his hearers that the latter were entitled to repayment of the sums overcharged, which he estimated at probably £7000 or £8000. It is proposed to take the opinion of Counsel as to whether the Company can be made to refund this, or any other sum, which is one way of creating or keeping open a rupture between the Commissioners and the Company. If there is to be any serious attempt by the Police Commissioners to acquire the gas undertaking, it will be a pity if the endeavours which some are making to embitter the negotiations should succeed. As yet it does not appear that such a result has been attained; for on Monday night the Lighting Committee, in a friendly spirit, appointed a Committee to meet with the Directors of the Company, and confer with them on the subject of the price of gas for public lamps.

A Joint Committee of the Edinburgh, Leith, and District Merchants' Association held a meeting on Tuesday night, and furnished to the newspapers an account of what they did, which included an instruction to the Secretary to communicate to the Gas Commissioners the dissatisfaction of the merchants with the price and quality of the gas supplied.

**From our Glasgow Correspondent.**

GLASGOW, *Saturday*.

Much additional interesting information on gas affairs has been communicated during the past week or ten days to the ratepayers in several towns where the gas supply is in the hands of the municipal authorities.

Beginning with Kilmarnock, I may first note some of the remarks made to his constituents the other evening by ex-Bailie Brown, who,

as Convener of the Gas Committee, is supposed to be thoroughly "up to the time of day" on such matters, so far as his own town is concerned. He proceeded to say that when, in 1872, the gas-works were acquired by the Corporation, the price paid for them was about £44,000, even though they were not of the most modern construction. The debt upon the works had now been reduced to £29,425; the works had been greatly improved; and the price of gas had been reduced from 5s. 10d. to 3s. 4d. per 1000 cubic feet. He said that great economy had been effected in the carbonizing department by the adoption of the Siemens system of regenerative furnaces; and that though every appliance about the works was of the most modern construction, they were still hardly complete, and under the present Manager (Mr. Fairweather) he believed that greater results would be attained in the future than in the past. A new demand for gas was arising from the extensive introduction of gas-engines. There were at present no fewer than 32 of such engines at work in the town; and last year they consumed upwards of 1¼ million cubic feet of gas. Now that the debt was considerably reduced, he (the Convener) would be in favour of lowering the price of gas to 3s. per 1000 cubic feet as soon as possible. He did not see the use of their going on paying off so much debt to favour posterity for all that posterity had done for them yet. One of the Convener's colleagues (Mr. Davie), speaking at the same ward meeting, took occasion to make special mention of Mr. Fairweather, saying that much of the credit for the success of the gas supply undertaking was due to his judicious and able management; it was under his care that the works had been remodelled. Another member of Council for the same ward (Mr. George Brown) said that the Gas Committee, with such an experienced Convener as ex-Bailie Brown, supported by such an efficient Manager as Mr. Fairweather for the gas-works, had gone on very satisfactorily. When addressing the ratepayers of the Second Ward on Thursday evening, ex-Bailie Carnie spoke as a member of the Gas Committee. He said that the town had been pretty well lighted during the past year—indeed, he thought he might venture to say better lighted than in any former year; and notwithstanding a considerable increase of expenditure, there had been a surplus of £2736 on the right side. Or rather, after all deductions, meter-rents, provision for new plant, &c., there was a balance of £1619. This had enabled the Gas Committee to recommend to the Town Council another reduction in the price of gas, which, he had no doubt, would be a great boon to all, and especially to small consumers. There was, he said, at the close of the past financial year a debt of £29,425 on the gas-works, but the accumulation of profits on hand, with which they were prepared to clear mortgages as they fell due, amounted to about £4000, which would reduce their indebtedness on the works account to about £2500. That was, he ventured to say, a very satisfactory position, and proof of the value of the improvements gone into some time ago, and also of the efficient management of the works.

Ex-Bailie Macfarlance, Convener of the Paisley Corporation Gas Committee, made an authoritative and important statement regarding gas affairs on Monday evening, to the annual meeting of his constituents of the First Ward. Next in importance to the new water-supply scheme, there was, he said, that of a new gasholder, the erection of which was in progress, and which was expected to be finished by the end of November. When completed, that holder would give a large addition to their storeage. Its available capacity was estimated at 1,400,000 cubic feet, which would add 150 per cent. to their present storeage accommodation; but it would all be required, for the consumption of gas last year was 10 million cubic feet more than that of the previous year, while from all appearances the year that had been entered upon would show an increase of 20 million cubic feet more. But the lowering of the price of gas was another cause to which they must attribute, in a great measure, the rapidly increasing consumption. The people were beginning to take more advantage of it for lighting and heating purposes than ever they did before, and the experience of the Gas Commissioners had been that instead of decreasing the surplus at the end of the year, the lowering of the price had rather tended to increase it. The surplus at last year's balance was about £4000, being £243 more than that of 1889. That, he thought, was a very satisfactory statement for the Gas Commissioners to lay before the people. The arrangement which the Commissioners had made for carrying on the operations in the gas-works for the current year did not look so bright, he was sorry to say, as on former occasions. Their expenditure would be very much increased, owing to the high price which they had had to pay for the coal required, which would average 1s. 7d. per ton more than the price last year. This would increase the year's expenditure something like £2000. The large extension that was being made at the gas-works—building new coal-stores and erecting a new gasholder—was estimated to cost £35,000; and the only available money which the Gas Commissioners had to pay this sum with was £8000—thus leaving a debt of £27,000. The interest on the borrowed money that would be required to meet the deficiency he (the Convener) estimated at £1000; making the expenditure from those two sources £3000 more than that of last year. But notwithstanding the very great increase in their expenditure during the current year, he was confident that it would be largely met by the profits which they would have from the extra sale of gas, from the higher price which they were getting for their ammoniacal liquor and tar (which would be £1000 more than that of last year), and from the saving that would be effected by the new system of setting the retorts for distilling the coal, which their Manager (Mr. Hislop) had introduced. When addressing the electors last year, he had said that the saving under the last-mentioned head would amount to about £1500; and from the experience which they had had, he was quite satisfied that the sum would be realized. In looking over the balance-sheet for 1888-9, when the old system of retort setting was in operation, he found that, after supplying the gas-works with all the fuel required for the regenerator furnaces, burning lime, and firing boilers, the surplus coke that was sold only realized £443; last year, however, when the new system of carbonizing was in operation, and the gas-works were supplied with all the fuel required for the retort furnaces, lime burning, &c., the surplus coke that was sold realized £1777. He had no doubt that in the year now entered upon, when more of the furnaces had been brought into use, the surplus coke available for sale would realize upwards of £2000, besides a saving of £600 in wages. The increased revenue from these various sources will, it is expected, go a long way towards meeting the heavy expenditure, and leave the surplus at the end of the year very little affected.

Other references to gas affairs in Paisley and elsewhere must in the meantime be held in abeyance; an exception being made, however, in favour of Port Glasgow. The First Ward electors in that town were addressed on Wednesday evening by Bailie Fyfe, who remarked that the gas supply undertaking of the burgh had turned out pretty favourable during the past year. But when he looked upon the debt that was still resting on the Gas Trust, he hoped that all the consumers of gas would bear in mind that, while they were paying a pretty high rate, they were helping to reduce the debt; and until that debt was reduced, they could not expect to get the gas much cheaper than the present price. Since 1865 the surpluses that had been accumulated had been the means of paying off £4000, and he hoped the ratepayers would continue to support the Gas Trust in the efforts they are making to wipe out the debt.

The Glasgow pig iron market has been comparatively steady this week, and Scotch warrants have fluctuated between 50s. 10d. and 50s. 1d., while the close yesterday afternoon was 50s. 5½d. per ton cash buyers. There is no change in the situation as regards the dispute between the ironmasters and the blast-furnace men. The latter seem to be thoroughly determined to continue the strike, while the former are equally determined to continue the lock-out. Already in two or three cases actions-at-law have been raised on both sides; and the feeling that has been engendered is decidedly bitter. The men are getting from the English Union 10s. per week and 1s. 6d. per week for each child under 12 years of age; and there seem to be plenty of funds yet forthcoming for all the men that are out of work through the stoppage of the blast-furnaces.

There is no new feature to report regarding the local coal trade. In some instances prices have eased off a little; and many of the miners that were working only four days a week in order to force an advance of wages have returned to five days a week. The advance has been given in one district; but elsewhere it is refused.

## CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 25.

**Sulphate of Ammonia.**—Although there is very little change in the market, there is a decidedly quieter feeling, due principally to the despondent tone of the nitrate market. The values of the latter are down about 3d. per cwt.; and this, combined with quotations for spring delivery on the basis of spot values, is hardly likely to influence consumers favourably as regards the future. The business in sulphate during the week has mostly been at the level of last week's prices, but at the close the same figures seem barely obtainable. £11 10s. is the nearest value at country ports. The tendency of nitrate will, no doubt, now keep consumers of sulphate back till the last moment; and although they may anticipate a decline in sulphate in sympathy with nitrate, it is quite as likely that they may be disappointed. The stocks of sulphate are small; and, as previously indicated, the consumptive demand may be larger than in previous seasons. It will be understood from the above that there is very little forward business doing.

LONDON, *Oct.* 25.

**Tar Products.**—Both pitch and anthracene are reported weaker. Large contracts, however, have been made for pitch. Makers, being well sold in anthracene, are not much concerned at the recent fluctuations in this market. Benzols continue stronger; whilst carbolic acid and common oils are somewhat weaker. A large gas contract has been entered into during the week at 27s. It is stated that naphthalene is coming into use as an illuminant, in competition with the lucigen and such-like lamps. Such an invention would be very welcome to tar distillers, who have much trouble in ridding themselves of this heretofore apparently useless product. To-day's prices are: Tar, 25s. to 30s. Pitch, 30s. to 32s. Benzols, 90 per cent., 4s. 6d.; 50 per cent., 3s. 5d. Toluol, 2s. 2d. Solvent naphtha, 1s. 9d. Crude naphtha, 1s. 7d. Creosote, 2¼d. Heavy oils, 3d. Carbolic acid, 60's, 1s. 7d. Cresol, 10d. Anthracene, 30 per cent., "A" quality, 1s. 5d.; "B" quality, 1s. 1d.

**Sulphate of Ammonia.**—There is undoubtedly a better feeling in this market. Large business is reported at prices ranging between £11 5s. and £11 10s. for 24½ per cent. stuff. Gas liquor, according to position, is quoted at 7s. to 8s. 6d.

**A Large Leakage.**—For some time, it has been suspected that there was a considerable leakage of water at Alfreton from the Local Authority's service pipes or mains. Experiments have been made to ascertain the whereabouts of the waste; and a few days ago, a leakage to the extent of 34,000 gallons a day was discovered in one pipe.

**The Lancashire Coal Trade.**—There was but a limited demand for most descriptions of coal during the past week, and quotations in some quarters were a shade easier, especially for large quantities. There is plenty of fuel of all kinds on the market, and the better sorts of round coal move off very slowly, considering the season of the year. For shipment there has been a distinct falling off in the demand; and the same remark applies to coal suitable for iron-making purposes. The commoner sorts of slack are being forced on the market, with the result that sellers have to accept easier terms. Most corporations and gas-making concerns have now contracted for their supplies to the end of the year and beyond; and matters in this line are quiet. At the pits, best house-fire coal averages about 12s. to 12s. 6d. per ton; seconds, 10s. 6d. to 11s.; and common round descriptions, 9s. to 9s. 6d. Burgy averages 7s. 6d. to 8s., with 6s. 6d. to 7s. for the better descriptions of slack. Commoner sorts of slack, however, can be had from 4s. 6d. up to 5s. and 6s. per ton. Fair qualities of steam coal for shipment are quoted at 10s. 6d. to 10s. 9d., and 11s. for the best delivered at the Liverpool Docks. Coke still keeps up in price, and there is no change in values to record.

**Australasian Gas Association, Limited.**—The Directors of this Company recommended a dividend at the rate of 7 per cent. per annum for the half year ended June 30 last.

**The Dangers of Spirit-Lamps.**—By the overturning of a spirit-lamp in the house No. 25, Lancing Street, Euston Square, shortly before midnight on the 18th inst., two sisters—Emily and Alice Rushbrook, aged 23 and 22 respectively—were so dreadfully burned that they had to be removed to the hospital, where the elder one has since died, and the other lies in a very precarious condition.

**A Suggestion for the Ipswich Corporation.**—A correspondent of the *East Anglian Times* (Mr. J. B. Fraser) makes a suggestion in last Thursday's issue, to the effect that the Ipswich Corporation should take steps to acquire the Water Company's undertaking, or obtain an alternative service. He makes no complaint as to the purity of the present supply, but argues that, water being essential to health, the authorities should supply it, as they are responsible for the health of the town. Another correspondent on the following day dealt with the same subject; the tenor of his letter being covered by the *nom de plume* which he used, "Look before you leap."

**Sales of Shares.**—Last Wednesday 35 shares in the *Worksop Gas Company* were publicly sold in the town. Five £10 5 per cent. preference shares fetched £12 12s. 6d. each; and five similar shares, £12 10s. Five £5 6 per cent. (third issue) shares realized £7 7s. 6d. apiece; and five other shares of the same class were disposed of at £7 15s. Four £5 7 per cent. (fourth issue) shares were knocked down at £8 10s. each; and nine similar shares produced £8 12s. 6d. Two £10 8 per cent. old shares were sold at £19 per share.——The same day a few £10 shares in the *Worksop Water Company* sold at £11 5s. and £11 10s. each——At Eckington on Tuesday, 206 fully paid-up shares of £1 each in the Eckington and Mosbro' Gas Company, Limited, were sold by auction; realizing prices ranging from £1 13s. 6d. to £1 15s. per share.

**Georgetown (British Guiana) Gas Company, Limited.**—In their report on the working of this Company during the half year ended June 30 last, the Directors state that the profit has amounted to £1419, which, added to the balance brought from the last accounts, makes £3278; and after paying the dividends to Dec. 31, 1889, and the interest on the debentures to June 30 last, there remains an available balance of £1987, out of which the Directors recommend the declaration of a dividend for the half year on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 7 per cent. per annum, both less income-tax (except upon those dividends payable to the local shareholders), which will leave a sum of £819 to be carried forward to the next half-year's account. The Directors announce, with great regret, the death of their esteemed colleague, Mr. Robert P. Drysdale, which occurred at Georgetown on Sept. 24 last.

**Oriental Gas Company, Limited.**—An extraordinary general meeting of this Company was held last Wednesday, to confirm a resolution, altering the rules and regulations of the Company, passed by the shareholders on the 1st inst. (see *ante*, p. 750). The Chairman (Mr. H. M'Lauchlan Backler), in moving the confirmation of the resolution, said that he explained everything fully at the last meeting; and he did not propose to go into the matter again. The motion was seconded by Mr. H. Solomon, and carried unanimously. In declaring the resolution carried, the Chairman said he wished to make a remark as to the difficulty in which they had been placed by the necessity for altering their regulations. What was wanted was the consolidation of all the Acts relating to joint-stock companies, and of the judicial decisions thereon; and any gentlemen who worked for this, either by communication with members of Parliament or with other companies, would be rendering a real service, not only to their own undertakings but to joint-stock companies in general.

**Bombay Gas Company, Limited.**—The report of the Directors of this Company, and the statements of accounts for the half year ending June 30 last, have been issued. Compared with the corresponding period of 1889, the gas and meter rental for the six months shows an increase of £1385. The receipts from other sources also exhibit a slight advance. There is an increased expenditure on coal carbonized, amounting to £886—due to an additional consumption of 168 tons, and to the advanced cost of coal. During the half year a sum of £30,000 was remitted from Bombay, at the average exchange of 1s. 5⅝d. per rupee; representing a loss on exchange of £10,806. Of this amount profit and loss has been charged with £7224, and the balance written off exchange equalization account. The balance at the credit of the general revenue account (after placing £2000 to the reserve fund) is £9053, out of which the Directors have declared an interim dividend of 3½ per cent., free of income-tax, for the half year, leaving £653 to be carried forward.

**Proposed Purchase of the Calverley District Water Company's Undertaking.**—At a recent special meeting of repesentatives of the Pudsey, Farsley, and Calverley Local Boards, convened to consider the future water supply of the three combined districts, after communications received from the Town Clerk of Bradford on the subject had been read, a resolution was unanimously adopted to the effect that they were of opinion that it was now desirable that the Calverley Water-Works Company should be approached in order to ascertain whether they were prepared to agree to the transfer of their undertaking and plant to the Boards, and if so, upon what terms; that the respective Boards be requested to authorize their representatives accordingly; that a deputation, consisting of two members from the Pudsey Local Board and one each from the Farsley and Calverley Local Boards, be appointed by their respective Boards, for this purpose; and that a meeting of the General Committee be called as soon as the deputation were prepared to report thereon. At a special meeting of the Pudsey Local Board, Messrs. Walker and Wilson were appointed the representatives of the Board upon the deputation to give effect to the resolution. A further resolution was also adopted as follows: "That the Board's representatives be authorized and empowered to give an undertaking if necessary to the Bradford Corporation that they will be prepared to take the water at the expiration of the Company's lease." The Company at present supply the greater portions of the three Local Board districts with water; but their lease terminates in 1893.

**Proposed Sewage Scheme for Cambridge.**—Some time ago, Mr. J. Mansergh, M. Inst. C. E., was called in by the Urban Sanitary Authority of Cambridge to advise them on the respective merits of two schemes submitted to them for dealing with the sewage of the town—one by Mr. Anson, and the other by Mr. Wood. His report was considered at the meeting of the Authority last Thursday. Mr. Anson advised a precipitation scheme, with intermittent filtration; Mr. Wood preferred the utilization of the sewage on the broad irrigation principle. The Committee who have had the matter in hand reported thereon, and recommended that Mr. Mansergh's conclusions as to the mode of collecting the sewage should be accepted, and that Mr. Wood should be asked to prepare an amended scheme of collection, in general accordance with the suggestions of Mr. Mansergh. Mr. Alderman Balls, in proposing the adoption of the Committee's report, said the question of diverting the sewage from the Cam had been before the Authority for many years; and the time had now arrived for them to decide upon a great and efficient scheme. Mr. Cobb seconded the motion, and it was adopted.

**Scarcity of Water in the Provinces.**—The Chairman of the Cardiff Corporation Water Committee reported last Friday week that they had then only 30 days' supply of water in store. When the present water-works were constructed, they provided for a daily consumption of 1 million gallons; whereas they were now using 2 millions. The Engineer (Mr. Williams) was instructed to prepare a report on the water supply of the borough.——The Portland Local Board having applied to the Local Government Board for sanction to borrow £3628 for the purchase of apparatus for cleaning, &c., Colonel Ducat, R.E., held an inquiry last Wednesday in respect thereto. From the statement of Mr. Webster, the Surveyor to the Local Board, it appeared that all the springs of water in the island did not yield more than 60,000 gallons per day in summer, or about 32,000 gallons per day all the year round; whereas, the population being more than 10,000, a supply of 200,000 gallons, or 20 gallons per head per day was required. An offer had been made by the Weymouth Water Company to deliver water 1½ miles from Portland for 6d. per 1000 gallons; and the Inspector evidently favoured this solution of the difficulty.

**Northern Coal Trade.**—The easiness in the coal trade generally has continued, being helped by the delay in the arrivals of steamers through fogs. Steam coal has been weaker; and best Northumbrian coal has been sold as low as 11s. 6d. per ton, free on board, which is 1s. 6d. below the prices of two months ago. Other qualities are at proportionate prices. Small steam coal is about 6s. 6d. per ton. Gas coal has been in more demand; and for odd cargoes, 11s. to 11s. 6d. is asked for best coal. One contract, for Lisbon, is concluded at about 16s. 6d. for coals, freights, and insurance—or less than the price above hinted at. Another contract for a Tyneside company is in treaty, and is expected to define more the recent tendency of the market. The local consumption of gas coal is enlarging satisfactorily. At Middlesbrough about 150 tons more is used monthly than last year. Bunker coals are lower in price; the demand being momentarily less. For manufacturing coals, requirements are steady; and the contracts for next year show little alteration from this year's price. In coke there is some improvement; and the price of best blast-furnace coke is raised to from 18s. 6d. to £1 per ton free on board. There is no change in the demand for gas coke.

**The Mill Dam Water-Works of the Hull Corporation.**—Last Saturday week the Hull Institute of Engineers and Naval Architects visited the new water pumping station of the Hull Corporation at Cottingham. They were conducted round the works by the Engineer (Mr. B. J. E. Bruce; and were very pleased with all they saw. The site of the new pumping station (which only recently started working) covers an area of 10 acres, in which are the Mill Dam Springs, which form the source of supply. In 1885 the Corporation entered into the first contract with Mr. B. Musgrave for the work, which embraced the sinking of two pumping shafts to a depth of 80 feet below the surface; also bore and headings. Next year the works were re-let to Messrs. Calvard and Strachan; and a third pumping-shaft was included in their contract (the shafts being 14 feet internal diameter), also the construction of a heading or tunnel in the chalk stratum for a distance of 500 feet, intersected by three shafts, at the bottoms of which are artesian bores 200 feet deep. In the same year Messrs. Amos and Smith, of Hull, entered into a contract with the Corporation for the machinery, which consists mainly of three sets of direct-acting compound engines; the high-pressure cylinders being 27 inches in diameter, and the low-pressure cylinder 49 inches, with 5 feet stroke. Each pair of engines, at a moderate speed, is capable of raising more than 3 million gallons per day. The boilers are steel, after the Lancashire type, five in number, 29 feet long, 7 ft. 6 in. in diameter, with two flues 2 ft. 10 in. in diameter.

**The Rochdale Water Supply and Lead-Poisoning.**—The members of the Littleborough Local Board had this subject brought prominently before them at their last meeting, by both the Medical Officer (Dr. Pitcairn) and the Nuisance Inspector (Mr. J. Whittaker). The latter reported that since the previous meeting he had seen the doctors of the district, and had found that the number of cases of lead-poisoning under their treatment was 49. These persons occupied 35 houses, which were all supplied with water by the Rochdale Corporation. The Medical Officer's report contained the results of analysis of three samples of water drawn from water-taps. One (which had been filtered) was free from lead; and the others "contained lead in sufficient quantities to be very injurious to health." A sample of water from the Hamer Pasture reservoir (from which, he believed, the district had of late been supplied) was found to have a decidedly acid reaction. The water of the Cown reservoir, from which Rochdale was chiefly supplied, was alkaline. The difference, he said, would of course account for the greater number of cases of lead-poisoning which occurred in the district and at Wuerdle and Wardle than in the borough of Rochdale. He was glad to say that the Local Government Board were about to inquire into the subject of lead-poisoning in its relation to public water supplies. A letter was also read from the Coroner, stating that at a recent inquest the verdict of the jury was death from chronic lead-poisoning, and suggesting that some representation should be made to the Rochdale Town Council on the matter.

**New Joint-Stock Companies.**—The following new joint-stock undertakings have just been registered: Howarth's Patent Gas-Burner Attachment Company, Limited, with a capital of £5000, in £1 shares; Lee-on-the-Solent Water-Works Company, Limited, with a capital of £2000, in £100 shares; Electro-Chemical Syndicate, Limited, with a capital of £5000, in £1 shares.

**The Birmingham Gas Workers' Society.**—The present Secretary of this Society (Mr. Beston) has announced his intention of resigning the position. One of the applicants for the office is Mr. Bloor, a member of the City Council; but he requires a guaranteed minimum salary of £150 a year. The settlement of the matter has been suspended; and in the meantime the various lodges will consider the claims of the five candidates for the post. At a meeting of the Executive Committee last Sunday week, it was stated that difficulties existed at the Saltley works, through unwillingness to recognize the Society; and it might be necessary to approach the Gas Committee.

**The Fullford Gas-Lamps.**—The Lamp Manufacturing Company, of No. 45, City Road, E.C., lately known as the Ridsdale Lighting Company, have completed their preparations for delivering various patterns of the Fullford regenerative gas-lamps. The value of this invention is that explosion is absolutely avoided on lighting, and that the flame immediately assumes its proper form; flash or pilot lights being rendered unnecessary. These lamps are made in three sizes, consuming 5, 10, and 15 cubic feet per hour respectively; and the various designs are known as the "Ceramic," the "Nickel," the "Doulton Ceramic," the "Frame," the "Popular," and the "Frame Ceramic." The firm are also making some fine specimens of ventilating lamps which carry away the products of combustion.

**Increase in the Price of Gas at Bristol.**—The Bristol Gas Company have given notice of a further rise of 3d. per 1000 cubic feet in the price of gas from Nov. 1; and the announcement has proved anything but welcome news to the consumers, as it was only a few months ago that the charge was increased to 2s. 7d. to cover the cost of the late strike. In a little more than a year, the price has gone up 8d.; and the explanation of this is that the coal contracts have to be renewed at a considerably increased cost. The difference to the ratepayer, as well as the consumer, will be very considerable. The cost of street lighting for the half year ending March last was £8143; for the half year ending September it was £9777; and the estimate for the ensuing half is £9600, which will be considerably under the mark, as the present advance in price will affect five out of the six months. The increase between the estimate for the half year ending March last and that for the ensuing term is £1600; or, roughly speaking, equal to a rate of ¾d. in the pound. The gas is not now supplied to the street lamps by contract, but on the same terms as to private consumers of more than a million cubic feet per annum, which terms are a little below those charged to ordinary consumers.

**The Condition of the Thames.**—At the meeting of the London County Council last Tuesday, the Main Drainage Committee reported as follows: With regard to the condition of the River Thames, the Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.) reports that, "while the rainfall from January to September, inclusive, is the same as the average for the corresponding period during the past 75 years, during September it was 2·4 inches below the average. The total flushing power of the upland water was nevertheless less than the average, in consequence of the ever-increasing intake of the Water Companies in the upper parts of the river. The five Companies whose supply is drawn solely from the River Thames supplied to their consumers in 1869 a daily average of 51,591,000 gallons; in 1879 they supplied 68,139,000 gallons; while in 1889 the quantity amounted to 83,468,000 gallons. Thus 32 million gallons more water were abstracted daily from the river than during 1869, or nearly 19,000 million gallons per annum. On the 6th inst., accompanied by the Medical Officer, I made an inspection of the river from Charing Cross to Wandsworth at low water, when thefore shores were exposed; and from the result of that inspection, and the analysis of samples of water, I am of opinion that no injury to health could accrue from the character of the river at that time. The result of repeated inspections during the past summer has been entirely confirmatory of that view."

**Provincial Gas Companies and the Laying of Mains in Outlying Districts.**—A short time ago the Westbury-on-Severn Rural Sanitary Authority instructed their Surveyor (Mr. W. Spence) to put himself in communication with the Manager of the Bilson Gas Company (Mr. J. Robb), with the view of ascertaining the terms and conditions upon which the Company would be prepared to furnish a supply of gas for the public lighting of Cinderford and other places within their jurisdiction. Mr. Robb replied that his Directors were willing to lay new mains in all the districts specified, with two exceptions, provided the Lighting Authority would undertake that the lamps should be lighted for not less than 1600 hours per annum, that the gas should be used for 15 years, that the number of lamps should not be reduced during this period, and that the lighting and extinguishing should be under his entire control. They also stipulated that in the event of the lighting being discontinued, the Company were to be paid £50 per annum during the unexpired term; or at the rate of £1 per annum for every lamp below the number agreed for. The price to be charged for gas was put at 4s. 6d. per 1000 cubic feet; the consumption to be ascertained by the average meter system. With regard to the two excepted districts, the Directors expressed their willingness to put down mains, provided the Lighting Authority would bear part of the cost; their proportion being fixed at £1250 in one case, and £250 in the other. When these conditions were laid before the Sanitary Authority at their last meeting, they were considered to be too stringent to be accepted. One member remarked that he did not think the Company wanted the job. Of course they did not wish to rush into heavy expense for laying mains in new districts without something like an adequate guarantee that their outlay would be reimbursed. But as for not wanting the job, it is absurd to suppose that the Company would refuse to take on fresh business if it was likely to be remunerative; and, as a matter of fact, they actually announced in the local paper their willingness to receive applications from householders and others desirous of becoming consumers. Only let the demand arise, and the Company would, in their own interests, soon take steps to satisfy it.

**Central Electric Light Station at Seville.**—There are not, says *Industries*, many electric light installations in Spain, but an important central station has been erected in the Calla de las Mozas, Seville. Four vertical compound engines are used, running at 350 revolutions; the pressure being 23lbs. The Oerlicon Maschinen-Fabrik have supplied the dynamos, which have a capacity of 480 ampères and 110 volts. The mains are all placed underground; and branches are taken off at suitable intervals. The cables consist of copper wires, insulated by several layers of pure vulcanized india-rubber; the whole being then placed in a leaden pipe. The glow lamps vary from 10 to 1000; and the arc lamps, from 500 to 1000 candle power.

**Lead-Poisoning at North Bierley.**—At a meeting of the North Bierley Local Board last Friday week, a letter was read from the Town Clerk of Bradford, stating that the Water Committee of the Corporation had inquired into the "alleged" cases of lead-poisoning that had been submitted to them by the Board. They had arrived at the conclusion that the water supplied by the Corporation had been, and is now, entirely free from traces of lead in any form. The Committee have endeavoured to obtain the best possible information as to the causes of the continuation of lead-poisoning, and believe they may be found in insufficient flushing, inordinate length of lead service pipes in certain instances, and neglect to run off each morning water that has been standing in a lead pipe overnight.

**Effect of the Strikes in South Australia on the Gas Supply.**—The South Australian Gas Company (Adelaide) issued, on the 6th ult., a notice to their consumers, to the effect that, owing to their inability to obtain coal in consequence of the prevailing strikes, they would, at the expiration of one calendar month, terminate their agreements to supply gas. They said they had no alternative to this course; but they would endeavour to keep up the service during the month, at the close of which they hoped to be in a position to enter into fresh agreements. In Sydney, too, the gas supply has had to be greatly curtailed owing to the scarcity of coal. But according to telegrams in yesterday's papers, the labour difficulties are now virtually at an end, the colliers having resumed work. It is therefore to be hoped that the normal conditions of gas supply will be quickly re-established, and the business go on in peace.

## GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 890.)

| Issue. | Share | When ex-Dividend. | Dividend for last Half-Year's Bonus. | NAME. | Paid per Share. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|---|
| £ | | | p. c. | GAS COMPANIES. | | | | £ s. d. |
| 590,000 | 10 | 10 Oct. | 10½ | Alliance & Dublin 10 p. c. | 10 | 16–17* | .. | 6 3 6 |
| 100,000 | 10 | ,, | 7½ | Do. 7 p. c. | 10 | 12–13* | .. | 5 15 6 |
| 300,000 | 100 | 1 July | 5 | Australian (Sydney) 5 % Deb. | 100 | 107–109 | .. | 4 11 9 |
| 100,000 | 20 | 30 May | 8 | Bahia, Limited | 20 | 20–22 | .. | 7 5 5 |
| 200,000 | 5 | 15 May | 7½ | Bombay, Limited | 5 | 6¾–7¼ | .. | 3 3 5 |
| 40,000 | 5 | ,, | 7½ | Do. New | 4 | 5–5¼ | .. | 5 9 1 |
| 380,000 | Stck. | 14 Aug. | 12½ | Brentford Consolidated | 100 | 212–217 | .. | 5 12 11 |
| 125,000 | ,, | ,, | 9½ | Do. New | 100 | 155–160 | .. | 5 15 7 |
| 220,000 | 20 | 11 Sept. | 11½ | Brighton & Hove Original | 20 | 40–42 | .. | 5 9 6 |
| 320,000 | 20 | 28 Mar. | 11½ | British | 20 | 43–45 | .. | 5 0 0 |
| 50,000 | 10 | 11 Sept. | 11 | Bromley, Ordinary 10 p. c. | 10 | 18–20 | .. | 5 10 0 |
| 39,000 | 10 | ,, | 8 | Do. 7 p. c. | 10 | 13–14 | .. | 5 14 3 |
| 328,750 | 10 | 13 June | 8 | Buenos Ayres (New) Limited | 10 | 12–13 | .. | 5 3 1 |
| 200,000 | 100 | 1 July | 6 | Do. 6 p. c. Deb. | 100 | 103–106 | .. | 5 13 2 |
| 150,000 | 20 | 14 Aug. | 8 | Cagliari, Limited | 20 | 25–27 | .. | 5 18 4 |
| 550,000 | Stck. | 10 Oct. | 13½ | Commercial, Old Stock | 100 | 245–250* | .. | 5 10 0 |
| 130,000 | ,, | ,, | 10½ | Do. New do. | 100 | 198–203* | .. | 5 5 11 |
| 130,000 | ,, | 27 June | 4½ | Do. 4½ p. c. Deb. do. | 100 | 119–124 | .. | 3 12 7 |
| 557,320 | 20 | 13 June | 13 | Continental Union, Limited | 20 | 49–50 | –½ | 5 4 0 |
| 242,680 | 20 | ,, | 13 | Do. New '69 & '72 | 14 | 34–36 | .. | 5 1 6 |
| 200,000 | 20 | ,, | 10 | Do. 7 p. c. Pref. | 20 | 36–41 | .. | 4 17 7 |
| 75,000 | Stck. | 25 Sept. | 10 | Crystal Palace District | 100 | 190–200 | .. | 5 0 0 |
| 234,060 | 10 | 16 July | — | European, Limited | 10 | 18–20 | .. | — |
| 120,000 | 10 | ,, | — | Do. New | 10 | 18–20 | .. | — |
| 354,060 | 10 | ,, | — | Do. do. | 7½ | 14–15 | .. | — |
| 5,470,620 | Stck. | 14 Aug. | 13 | Gaslight & Coke, A, Ordinary | 100 | 255–259 | .. | 5 8 10 |
| 100,000 | ,, | ,, | 4 | Do. B, 4 p. c. max. | 100 | 98–101 | .. | 3 19 3 |
| 665,000 | ,, | ,, | 10 | Do. C, D, & E, 10 p.c. Pf. | 100 | 247–252 | .. | 3 19 4 |
| 30,000 | ,, | ,, | 5 | Do. F, 5 p. c. Prf. | 100 | 119–123 | .. | 4 1 3 |
| 60,000 | ,, | ,, | 7½ | Do. G, 7½ p. c. do. | 100 | 177–182 | .. | 4 2 5 |
| 1,300,000 | ,, | ,, | 7 | Do. H, 7 p. c. max. | 100 | 164–168 | .. | 4 3 4 |
| 463,000 | ,, | ,, | 10 | Do. J, 10 p. c. Prf. | 100 | 246–251 | .. | 3 19 8 |
| 1,061,150 | ,, | 13 June | 4 | Do. 4 p. c. Deb. Stk. | 100 | 113–120 | .. | 3 6 8 |
| 294,850 | ,, | ,, | 4½ | Do. 4½ p. c. do. | 100 | 123–128 | .. | 3 10 4 |
| 650,000 | ,, | ,, | 6 | Do. 6 p. c. do. | 100 | 161–166 | .. | 3 12 3 |
| 3,800,000 | Stck. | 15 May | 12 | Imperial Continental | 100 | 220–223 | .. | 5 7 7 |
| 75,000 | 5 | 13 June | 6 | Malta & Mediterranean, Ltd. | 5 | 5¼–5¾ | .. | 5 4 4 |
| 560,000 | 100 | 1 Oct. | 5 | Met. of Melbourne, 5 p. c. Deb. | 100 | 109–111 | .. | 4 10 1 |
| 541,920 | 20 | 13 June | 7½ | Monte Video, Limited | 20 | 19–20 | –½ | 6 10 0 |
| 150,000 | 5 | 30 May | 10 | Oriental, Limited | 5 | 9–9¼ | .. | 5 5 3 |
| 60,000 | 5 | 25 Sept. | 7 | Ottoman, Limited | 5 | 5–5¼ | .. | 6 7 3 |
| 166,870 | 10 | 16 July | 4 | Pará Limited | 10 | 3–4 | –½ | 10 0 0 |
| | | | | People's Gas of Chicago— | | | | |
| 420,000 | 100 | 2 May | 6 | 1st Mtg. Bds. | 100 | 98–102 | .. | 5 17 8 |
| 500,000 | 100 | 2 Dec. | 6 | 2nd Do. | 100 | 95–100 | .. | 6 0 0 |
| 150,000 | 10 | 10 Oct. | 10 | San Paulo, Limited | 10 | 15–15* | .. | 6 5 0 |
| 500,000 | Stck. | 28 Aug. | 13½ | South Metropolitan, A Stock | 100 | 283–288 | .. | 4 12 0 |
| 1,350,000 | ,, | ,, | 11½ | Do. B do. | 100 | 227–232 | .. | 4 19 1 |
| 141,500 | ,, | ,, | 12 | Do. C do. | 100 | 235–245 | .. | 4 17 11 |
| 650,000 | ,, | 27 June | 5 | Do. 5 p. c. Deb. Stk. | 100 | 142–147 | .. | 3 8 0 |
| 60,000 | 5 | 11 Sept. | 11½ | Tottenham & Edm'nton, Orig. | 5 | 11–13 | .. | 4 8 5 |
| | | | | WATER COMPANIES. | | | | |
| 728,446 | Stck. | 13 June | 9½ | Chelsea, Ordinary | 100 | 270–273 | +1 | 3 9 1 |
| 1,720,560 | Stck. | 10 Oct. | 7½ | East London, Ordinary | 100 | 211–216* | +2½ | 3 9 5 |
| 544,440 | ,, | 27 June | 4½ | Do. 4½ p. c. Deb. Stk. | 100 | 142–147 | +2 | 3 1 2 |
| 700,000 | 50 | 13 June | 9 | Grand Junction | 50 | 121–126 | +1½ | 3 11 3 |
| 708,000 | Stck. | 14 Aug. | 10½ | Kent | 100 | 271–276 | +1 | 3 16 0 |
| 1,043,800 | 100 | 27 June | 9½ | Lambeth, 10 p. c. max. | 100 | 254–257 | +3 | 3 13 11 |
| 406,200 | 100 | ,, | 7½ | Do. 7½ p. c. max. | 100 | 197–202 | .. | 3 14 3 |
| 225,000 | Stck. | 25 Sept. | 4 | Do. 4 p. c. Deb. Stk. | 100 | 120–124 | .. | 3 4 6 |
| 500,000 | 100 | 14 Aug. | 12½ | New River, New Shares | 100 | 361–366 | .. | 3 6 3 |
| 1,000,000 | Stck. | 31 July | 4 | Do. 4 p. c. Deb. Stk | 100 | 125–128 | .. | 3 2 6 |
| 902,300 | Stck. | 13 June | 6 | S'thwk & V'xhall, 10 p. c. max. | 100 | 170–174 | .. | 3 9 0 |
| 126,500 | 100 | ,, | 6 | Do. 7½ p. c. do. | 100 | 158–163 | .. | 3 13 7 |
| 1,155,066 | Stck | 13 June | 10 | West Middlesex. | 100 | 265–270 | .. | 3 14 1 |

*Ex.div.

## GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams:
"GWYNNEGRAM LONDON."

TELEPHONE No. 2698.

# GWYNNE & CO.,

**HYDRAULIC AND GAS ENGINEERS,**

**ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.**

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

They have completed Exhausters to the extent of 22,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

**Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.**

Exhausting Machinery at Fulham and Bromley Gas-Works—each set passing 400,000 cub. ft. per hour, drawing 14 miles distant from Beckton.

**Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.**

Catalogues and Testimonials on application.


**NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

**Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAYS.**


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**O'NEILL'S Oxide has a larger annual** sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
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**JOHN ROMANS & SON, EDINBURGH.** Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
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Head Office: MIDDLESBROUGH. Correspondence invited.

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**A GENTLEMAN, having established** connections with Gas Companies in England, would be glad to REPRESENT a COLLIERY, raising good Gas Coal and Cannel. Highest references.
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**WANTED, a first-class Gas-Fitter.** Apply, stating Age, Wages required, and Experience, with references, to No. 1873, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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**WANTED, a married Man as Working** MANAGER, FITTER, and COLLECTOR. Security required, £100. Free Residence, large Garden, Coal, &c., at the Works.
Apply, stating age, experience, and qualifications, with testimonials, to the SECRETARY, 42, Belvoir Street, LEICESTER.

**JAMES LAWRIE & CO. supply Best** SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
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*** See Advertisement p. 869 of last week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

**J. & J. BRADDOCK, Globe Meter Works,** Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

**REQUIRED, for a Gas-Works on the** West Coast of South America, a GENERAL FOREMAN, possessing a thoroughly practical knowledge of Carbonizing, Retort-Setting, Meter Repairing, the "Otto" Gas-Engine, and the usual duties of a Gas-Works, including the keeping of the Yard Books. Must be competent to take the entire charge of the Works during the absence of the Manager. One who has held the position of Working Manager on a small Works, and accustomed to direct Men, will be preferred. The make of Gas is 2 million cubic feet per month.
Apply, by letter, stating full particulars, to FOREMAN, care of Lee and Nightingale, Advertising Agents, LIVERPOOL.

**RETORT CARBON wanted, by a London** Firm, in quantities of from 2 to 3 tons per month.
Send prices, &c., to No. 1871, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, to purchase Gas Carbon,** delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating price per ton and quantity, No. 1766, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, to purchase a set of three** (10 feet square) PURIFIERS, with Valves, Connections, and Wood Grids complete. A STATION METER, to pass from 6000 to 8000 cubic feet of Gas per 24 hours, with 8-inch Bye-Pass and Connections. Also a STEAM-BOILER, about 9 ft. by 4 ft., with Flue in centre. All on rail, and in good order. State lowest price.
Address, No. 1872, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

IRISH BOG ORE OXIDE OF IRON.

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**BALE, BAKER, & CO., direct Importers** from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
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**FOR Gas, Steam, and Water; Galvanized** White Enamelled, and Hydraulic Tubes, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

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**JOHN NICHOLSON & SONS, Chemical** Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

**COZE'S Automatic Apparatus for** CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 780.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

**HUTCHINSON BROTHERS, Barnsley,** Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

**SULPHURIC ACID delivered in Manu-** facturers' Tanks or Carboys.
Prices on application to HARDMAN and Co., Miles Platting, MANCHESTER.

BENTLEY & CO.

MANCHESTER ELECTRICAL STORES.

**FOR Batteries, Bells, Wires, and Special** Electrical Apparatus, address the best house
17, NEWTON STREET, PICCADILLY, MANCHESTER.

**EXTRACT from the Harrogate Gas** Company's Report, dated the 5th of February, 189 : Coal consumed, 8600 tons. Gas made, 92,880,000 feet; ditto sold, 84,880,000 feet; ditto unaccounted for, 8,000,000 feet; quantity made per ton, 10,800 feet; ditto sold, 9869 feet. Illuminating Power, 16·1 candles. Coals used, Brancepeth. Owners, Strakers and Love, Newcastle-on-Tyne; who have also Brandon Hutton Seam Unscreened Gas Coal. Analysis, 10,500 cubic feet per ton; Illuminating Power, 16·2 candles.

SPENT OXIDE.

**THE Winchester Water and Gas Com-** pany have FOR SALE about 40 tons of SPENT OXIDE.
Samples can be obtained of, and offers (on rail at Winchester) should be made to
W. UPTON TINNEY, Manager.

**FOR SALE—A Bargain.** One 6-inch GOVERNOR complete, with 6-inch Inlet, Outlet, and Bye-Pass Valves. Equal to New. Has been replaced by a larger one. Price £10 10s.
Apply to the MANAGER, Gas-Works, Ware, HERTS.

**FOR SALE—Wrought-Iron Cylindrical** SCRUBBER, 9 ft. by 3 ft. 6 in., Distributor, filled with Boards. HAND PUMP, 2½-inch ram. May be bought cheap.
Apply to T. SETTLE, Manager, Gas-Works, New Mill, near HUDDERSFIELD.

TO INVESTORS.

**THE Directors of the Town and County** of Poole Gas and Coke Company, Limited, have FOR DISPOSAL 23 4 per cent. PREFERENCE "C" SHARES of £10 each.
This being a safe Investment, early application should be made to the Secretary, who will supply all particulars.
By order.
WILLIAM DAVIS, Secretary.
Gas Office, Poole, Oct. 7, 1890.

BY ORDER OF THE TRUSTEES OF THE LATE R. J. DICKINS, ESQ.

CROYDON GAS COMPANY.

Sale of 633 Shares in the Croydon Gas Company, producing Dividends at the rate of 14 and 11 per cent; per annum respectively.

**THURGOOD and MARTIN have received** instructions to SELL BY AUCTION at the Greyhound Hotel, High Street, Croydon, on Thursday, Nov. 6, 1890, at Six o'clock precisely, in 64 Lots, *cum div.*, 294 SHARES (£5 fully paid), producing Dividends at the rate of 14 per cent. per annum, and 338 SHARES (£5 fully paid), producing Dividends at the rate of 11 per cent. per annum, all in the Capital of the Croydon Gas Company.
An excellent opportunity for the secure investment of large or small sums; the Dividends being well secured against fluctuation by ample Reserve and Insurance Funds.
Particulars and conditions of sale may be had of Messrs. LOVELL, SON, and PITFIELD, Solicitors, 3, GRAY'S INN SQUARE, W.C.; at the place of Sale; and of the AUCTIONEERS, 27, CHANCERY LANE, W.C.

WEST HAM GAS COMPANY.

SALE OF 1250 SHARES.

**MR. ALFRED RICHARDS is favoured** with Instructions from the Directors to SELL BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, Nov. 4, at Two o'clock precisely, in lots of 10 Shares each, 1250 £10 SHARES in the West Ham Gas Company.
The Standard Dividend authorized by the Company's Act of Parliament is 7 per cent.; but a reduction of 3d. per 1000 cubic feet below the standard price of gas having been made, it would, under the Sliding-Scale Clauses be competent for the Shareholders to declare a Dividend of 7¾ per cent. in respect of these Shares.
Particulars may be obtained at the MART; of the SECRETARY to the COMPANY, STRATFORD, E.; of Messrs. HILLEARY, Solicitors, 5, FENCHURCH BUILDINGS, E.C., and of the AUCTIONEER, 8, NEW BROAD STREET, E.C.

BRISTOL WATER-WORKS COMPANY.
AUTHORIZED CAPITAL, £1,705,000.

SALE BY TENDER OF £50,000 7 PER CENT. MAXIMUM ORDINARY STOCK.
MINIMUM PRICE, £140 PER CENT.

**THE Company are prepared to receive** TENDERS for the above STOCK on or before the 14th of November, 1890. The Stock to be paid up in full by the 21st of December, 1890.
Particulars and conditions of sale and forms of tender can be obtained at the Company's Office, Small Street, Bristol.
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Swansea, Oct. 23, 1890.

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GREATER DURABILITY,

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OF THE
# METROPOLITAN WATER COMPANIES,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex. Showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied, for the year ended December 31, 1889, or March 31, 1890, together with the quantity of water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1889.

Compiled and arranged by **ALFRED LASS,** Fellow of the Institute of Chartered Accountants.

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When the Purifiers are fixed in square.

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*DESCRIPTIVE PAMPHLET ON APPLICATION.*

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Illuminating Power - - - - - 26 Candles.
Coke per Ton, - - - - - - - 57 per cent. of a quality almost equal to that made from the best Coking Coal.

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*Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,*

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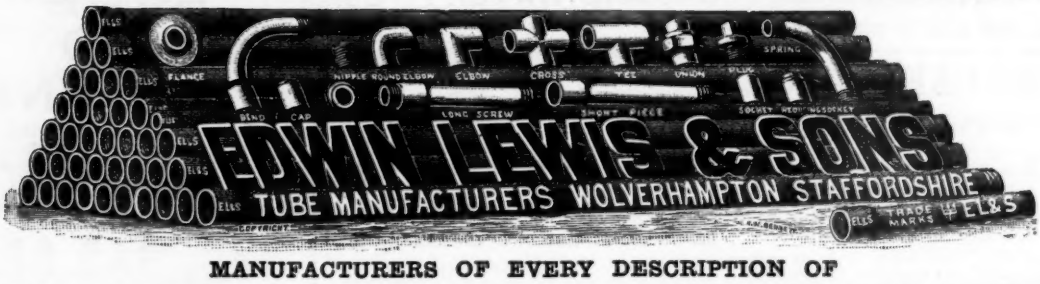


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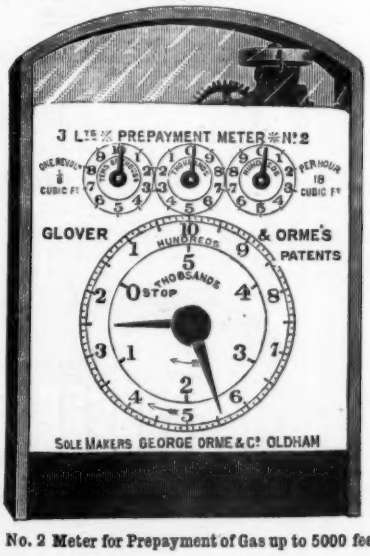


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**In two sizes, 24 and 28 ins. wide over base, exclusive of Register.**

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**ALDWARKE MAIN GAS COAL**
Analysis: 12,600 feet of 19-candle gas per ton.
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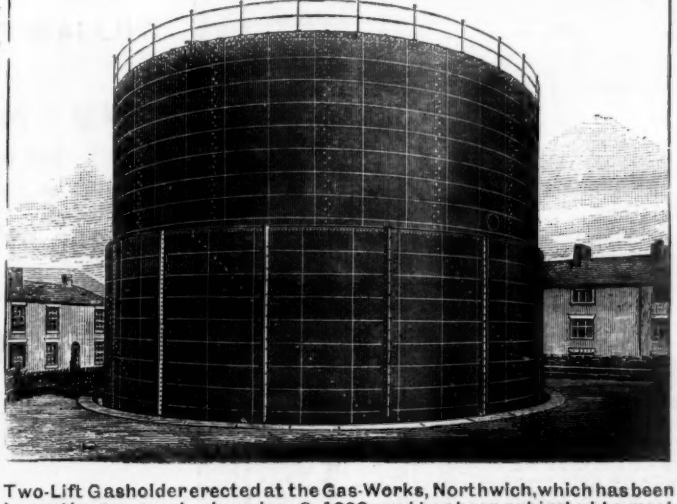
The Tank wall (of whatever construction) is a regular cylinder. There are no piers needed, and all expensive foundation stones for the base of columns or standards are dispensed with.



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As supplied to and approved of by H.M. Government.

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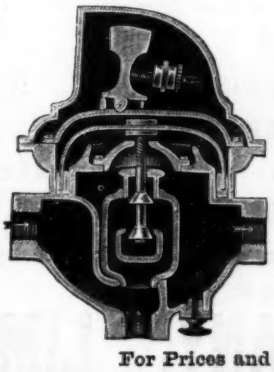

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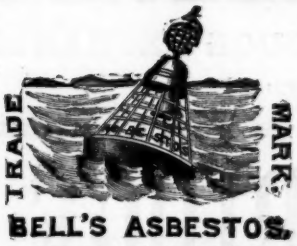
# AQUOL  PAINT



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IS MANUFACTURED IN ALL USEFUL COLOURS.
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IS WITHOUT SMELL.

**No expensive Oil or Turpentine required.**

WILL NEVER BLISTER.

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## BELL'S ASBESTOS AQUOL PAINT.

BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.
BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.
BELL'S ASBESTOS AQUOL PRIMING should be applied to all New Work.

Suitable for Ceilings, Walls, and New Wood, and is very durable.

*BELL'S ASBESTOS AQUOL KNOTTING, for Stopping Knots in New Work.*

AN EXCELLENT CURE FOR DAMP WALLS.

**Colour Cards and Price Lists on Application.**

Supplied in Casks of 5 to 7 cwt., and Iron Drums of 28, 56, and 112 lbs., Sample Tins of 7 and 14 lbs.

Owing to its Covering Capacity, a SAVING IN FREIGHT of 40 per cent. is effected for a given surface.

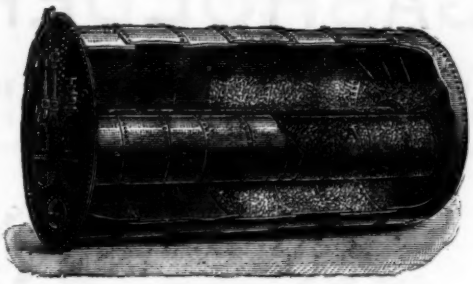
## BELL'S ASBESTOS COMPANY, LIMITED,

SOUTHWARK, LONDON, S.E.

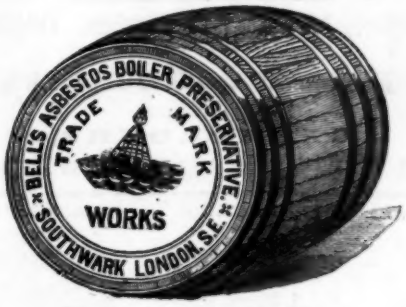
DEPOTS—MANCHESTER: Cable Street, Blackfriars. LIVERPOOL: 2, Strand Street, James Street. HULL: Humber Dock Basin. GLASGOW: 35, Robertson Street. DUBLIN: 2, St. Andrew Street. AMSTERDAM: 264, N. Voorburgwal. BERLIN, BARCELONA, and ANTWERP.
AGENTS—BIRMINGHAM: BELL and Co., 7, John Bright Street. BRISTOL: ROBERT STOTESBURY 114, Redcliffe Street. CARDIFF: BELL and Co., West Bute Street.

# BELL'S ASBESTOS BOILER PRESERVATIVE

**Will remove Incrustation from Steam-Boilers of all kinds without chipping.**



A shows Boiler Plates when incrusted.
B shows Boiler Plates when cleaned by this Composition.



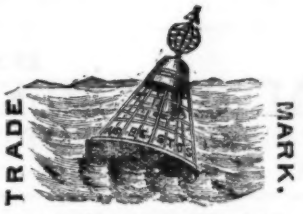

Every Cask is sent out as above.

The action of this **BOILER PRESERVATIVE,** by absorbing the free oxygen that is in the water, **entirely checks pitting and corrosion.** It also disintegrates incrustation so immediately as to prevent its adhering to the plates; and the deposit falls to the bottom in a loose powder, which is easily swept out. By keeping boilers clean, a **great economy of fuel is effected,** and the danger of the plates burning is entirely obviated; thus avoiding the great risks which are inseparable from scaled plates, lengthening the life of a boiler, and **covering its own cost a hundredfold.** Whenever possible it should be used through Feed Pump or Injector, which it will also keep clear from incrustation. The small quantity required to effect its purpose makes this the most economical, and more than repays the higher price we charge for a fluid which, in the case of many other makers, is useless.

**QUANTITY REQUIRED.** A quarter of a pint weekly per horse power indicated; where the water is very bad rather more, or one pint for every 700 gallons of water evaporated.

# BELL'S ASBESTOS CO., Ld.

**DEPÔTS.**
MANCHESTER: Cable St., Blackfriars.
LIVERPOOL: 2, Strand St., James St.
HULL: Humber Dock Basin.
GLASGOW: 35, Robertson Street.
DUBLIN, BERLIN.
AMSTERDAM: 264 N. Z. Voorburgwal.




**DEPÔTS.**
BARCELONA, and ANTWERP.

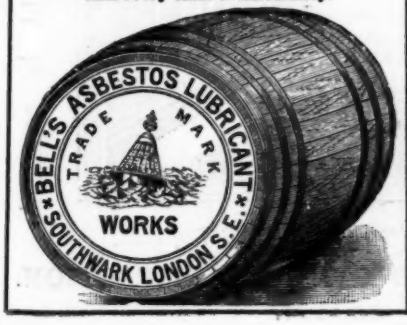
**AGENTS.**
BIRMINGHAM: BELL and Co., 7, John Bright Street.
BRISTOL: ROBERT STOTESBURY, 114, Redcliffe Street.
CARDIFF: BELL and Co., West Bute St.

**SOUTHWARK,** BELL'S ASBESTOS. **LONDON, S.E.**

BELL'S ASBESTOS
## YARN AND SOAPSTONE PACKING
the BEST LOCOMOTIVE PACKING made.

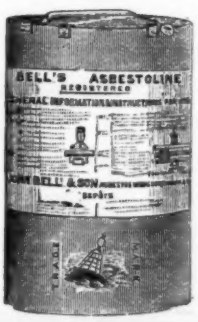
BELL'S
## COMPOUND HYDRAULIC PACKING
Is specially suited for
Hydraulic Machinery, Accumulators and Ammonia and all Pumps.

## BELL'S ASBESTOS LUBRICANT
Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.




## BELL'S ASBESTOLINE
The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

ASBESTOLINE IS THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.




ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL.
Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

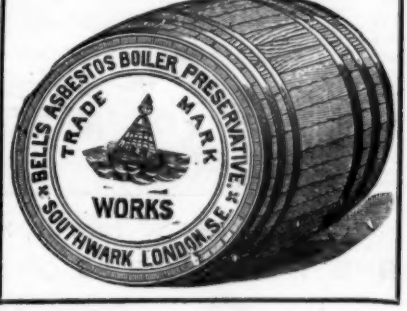
BELL'S ASBESTOS
## EXPANSION SHEETING
RINGS, AND TAPE.
Is the most efficient and reliable Material for Manhole, Mudhole, Steam-Pipe, and all other Joints.

BELL'S ASBESTOS
## NON-CONDUCTING COMPOSITION.
Will reduce loss by radiation and saves 40 per cent. of fuel.
Is superior to any other, and saves its cost in a few months.

Can be supplied again after many years' service. Is sent out dry in bags; therefore cheaper than others sent out wet.

ALL BAGS ARE MARKED AS ABOVE.

BELL'S ASBESTOS
## BOILER PRESERVATIVE
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



# HORSELEY COMPANY, LTD.

TIPTON, STAFFORDSHIRE.

London Office: 6, Westminster Chambers, Victoria Street.

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS,

AND ALL KINDS OF GAS AND WATER WORKS PLANT.

Gas-Bags for Mains. High-Water Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpaulin Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber, and Stokers' Gloves.

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**THOMAS BUGDEN, Manufacturer,**

116 & 118, GOSWELL ROAD, LONDON, E.C.

# HENRY BALFOUR & CO.,

LEVEN, FIFE,

MAKERS OF

# GASHOLDERS

And all classes of GAS PLANT,

REVOLVING BRUSH SCRUBBERS, FOUR-WAY VALVES.

*LONDON: 13, BILLITER STREET, E.C.*

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CLAYTON, SON, & Co.

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MAKE

# RETORT LIDS

OF ALL FORMS AND SHAPES

IN IRON OR STEEL

BY SPECIAL HYDRAULIC MACHINERY.

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PRICES ON APPLICATION.

# GAS COAL.

BEST

COAL OLD SILKSTONE GAS COAL.

Address, THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

THE CHEAPEST AND BEST LAMP IN THE MARKET.

Suitable for every place where Gaslight is required.

*Invaluable for Mills, &c., where the maximum of Light is required at a minimum of cost.*

ONE WORKS HAS 96 OF THESE LAMPS FIXED AND GIVING SATISFACTION.

AGENTS WANTED IN EVERY TOWN.

## WILLIAM INGHAM & SONS,

WORTLEY FIRE-CLAY WORKS,
Near LEEDS

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing Adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

## JONAS DRAKE & SON.

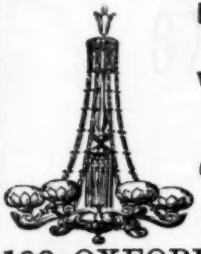
—GAS— —ENGINEERS— —CONTRACTORS— —IRONFOUNDERS— —RETORT SETTERS— —ETC.—

Specialities in CARBONIZING PLANT.
GENERATOR AND REGENERATOR FURNACES.

OVENDEN,
HALIFAX (YORKS.)

## F. & C. OSLER,

(ESTABLISHED 1807)



MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES,

TABLE GLASS OF ALL KINDS,
CHANDELIERS IN BRONZE AND ORMOLU.
MODERATOR LAMPS.

100, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
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## "THE METEOR."

NEW HIGH-POWER GAS-LAMP.
Westphal's Patent.

Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

*Particulars and Prices Free.*

HENRY GREENE & SONS,
SOLE CONSIGNEES FOR GREAT BRITAIN & COLONIES
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## PREPAYMENT GAS-METER.

(PRICE'S PATENT).

This Meter has a simple Automatic arrangement fitted, whereby, upon the insertion of a shilling, a supply of gas can be obtained, and which is cut off on the quantity paid for being consumed. The Meter gives warning when the quantity is nearly exhausted, so that another shilling may be inserted. There is, however, no occasion to wait until this happens, as a second shilling can be inserted after two-pennyworth of the first shilling has been consumed.

The Meter is fitted with the ordinary registering dial, and has in addition a circular one divided showing twelve pence. On each Meter is marked the number of cubic feet it will pass for one shilling; and this can be arranged to cover cost of Meter-Rental, Fitting, and Gas consumed. These Meters are made of the best material and workmanship.

SPECIALLY ADAPTED FOR INCREASING CONSUMPTION AMONGST SMALL CONSUMERS.
NO RISK OF BAD DEBTS.

PROPRIETORS AND MANUFACTURERS:

D. HULETT & Co., LIMITED,
GAS-METER MAKERS, 55 & 56, HIGH HOLBORN, LONDON.

# RED OXIDE PAINT

Ready mixed for use or in Paste form. Special Quotations at lowest rates, according to quantity, on application to

**ADOLPHE CROSBIE, Walsall Street Chemical Works,**

**WOLVERHAMPTON.**

This paint is in use at many Gas-Works. Sample 5-gallon can, ready mixed, price 18s. 9d.

## SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

# The Schülke Regenerative Lamp

FOR
**DOMESTIC AND EXTERNAL LIGHTING.**

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

**PURE WHITE & PERFECTLY STEADY LIGHT,**
NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).
Can be fixed in a few minutes.

May be seen at the Offices of the
**SCHÜLKE GAS-LAMP Co.**
LIMITED,
**20, HIGH HOLBORN,**
**LONDON, W.C.,**
Where Price Lists and full particulars may be obtained.

# WATER GAS.

## THE BRITISH WATER GAS SYNDICATE, LTD.,

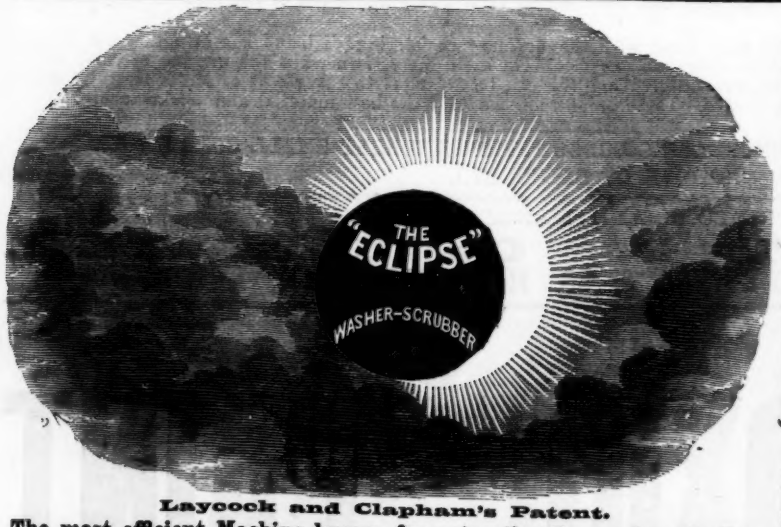
Is prepared to give Estimates for, and undertake the erection of,

*Water-Gas Plant for Steel Manufacture, Puddling, Glass Melting, Singeing Fabrics, &c.; and for Illuminating and all other purposes.*

Competent Engineers are sent out to advise as to the best means of application.

## The BRITISH WATER GAS SYNDICATE, LTD., LEEDS.

Telegrams—"WATERGAS, LEEDS."




**Laycock and Clapham's Patent.**
**The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas.**
**MACHINES** with a total capacity of **42,500,000** cubic feet now working, and give great satisfaction.
*LAST YEAR 11 Machines erected with a total capacity of* **20,000,000** *feet.*

*Send for Descriptive Catalogue to the Sole Makers:*
**Clapham Bros., Wellington, Nelson, & Market St. Works,**
**KEIGHLEY, YORKS.**
Agents:—Mr. W. F. Roe, 52, Queen Victoria Street, E.C.
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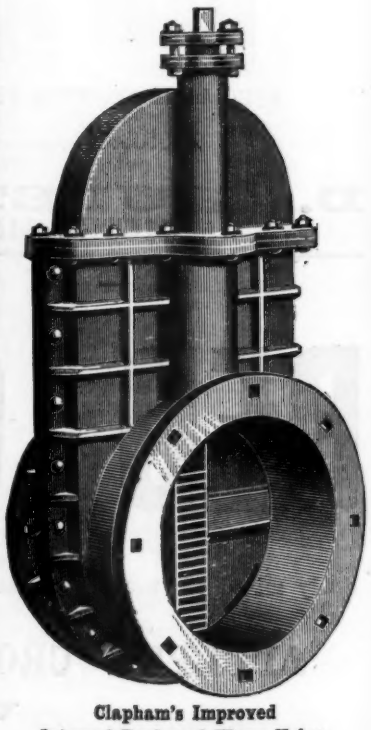
Mr. E. H. Wardwell, 10, Warren Street, New York, U.S.

**SILVER MEDAL, Inventions Exhibition, 1885.**



Clapham's Improved Internal Rack and Worm Valve, Gas-Mains, &c.


London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Oct. 28, 1890